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Meeting Peaks Ten Years Hence

The position of local stations

TWO main factors affect the methods of generating electricity to meet demands of relatively short duration. The first is the interconnection of power stations by means of the grid, as a result of which their capacity may bear little relation to the purely local demand; the other is the changing character of the load curve with the growth of domestic uses, especially cooking.

Despite the experience of supply engineers who have gone out for development of domestic load on bold lines, there are many who fear lest the diversity of the cooking with other loads, which has up to now justified the low prices charged, will not be maintained, and that an actual drop in the load factor with consequently increased costs of generation is to be expected. It is opportune at this stage to investigate the probable position, say, ten years hence, not only because plans for generation have to be made well ahead of demand, but also because no room should be left for doubts as to the paying nature of the domestic load in circumstances that may be expected to prevail in the future.

Under present conditions, the total costs of production are not seriously affected by the operation of comparatively old and uneconomical plant for supplying the small proportion of energy sent out during peaks, while the height of the peak can easily be coped with by such plant on which capital charges have to be met in any case. A very different situation arises, however, when peak energy becomes an appreciable percentage of the whole output and when its magnitude is greater than the capacity of existing obsolescent boilers and turbines.

Although it may not be essential, under grid operation, to run local stations for dealing with peaks at load centres, it is often convenient to do so with a view to reducing difficulties of transmission in congested areas. Such areas more often than not provide favourable conditions, within limits, for generating electricity; that is to say, water is plentiful and access by rail, road or river is easy—two advantages that encourage power-consuming industries to select the same districts.

The chief objection to such sites is the cost of land and high local rates. Plant dimensions, therefore, become of dominant importance. As the tendency of progress in engineering is to secure reductions in size and weight per h.p., not less than it is to obtain higher thermal efficiencies, the satisfying of this requirement of compactness is strictly in line with evolutionary advance. The contention that there is everything to be said for adopting the latest technical developments in the construction of plant for meeting peaks receives support from the investigations of Mr. D. H. Parry, who shows in this issue that there is little to be said, even on grounds of overall capital costs, for building low-grade units for the purpose, since any gain in expenditure on the boilerhouse and turbine room is likely to be more than offset by other charges due to questions of physical space.

Two more points have to be borne in mind. They are that units should be designed to lend themselves to running at a high-plant load factor, irrespective of what the system load factor may be (*e.g.*, they should be quick-starting), and the stations or units now running on base load will in time be relegated to a lower category. Where the original steam pressure is not much more than 300 lb. per sq. in., it seems probable that scope will be found here for the superposition of extra-high-pressure primary turbines, exhausting into the range supplying the older sets, thus adding perhaps 50 per cent. to the generating capacity and improving the overall thermal efficiency of the station.

Experience in the electrical world has been that technical progress may justifiably be expected to keep pace with the expanding requirements of the public. Provided full advantage is taken of every technical advance, there appears to be no good reason (in so far as the position depends on engineers) to doubt that, even if load factors should decline, the falling trend in overall generating costs will continue.

Factory Lighting

AN enormous amount of business should accrue to the electrical industry from the requirements of the new Factory Act. An important provision is that each of 278,000 establishments affected by the Act shall have "sufficient and suitable" lighting. What such lighting is has yet to be defined by the Home Office, but it is safe to say that a substantial proportion of the factories and workshops of this country are susceptible to improvement so far as their lighting arrangements are concerned. The fact that about a third of industrial accidents can be attributed to bad lighting is sad proof of this. It is, therefore, most opportune that the British Electrical Development Association, in co-operation with the Electric Lamp Manufacturers' Association, should be devoting this season's Better Lighting Campaign to industrial illumination. Brief details of the plans appear on another page, from which it will be seen that, once again, a leading rôle is assigned to the lightmeter, that inexpensive, efficient and convincing little instrument which no supply authority or contractor can afford to be without.

Calcium Carbide

ONE of the principal factors in the economic production of calcium carbide is an ample supply of cheap electric power. For this reason, when the British Oxygen Co. contemplated the large-scale manufacture of the product it promoted the Caledonian Power Bill, which, it was claimed, would enable electricity to be generated at a very low cost and also permit the construction of a factory at Port Talbot, Glamorgan, which would use coal-generated power. When the House of Lords rejected the Bill it was thought that the Port Talbot works might still be proceeded with, but the company eventually decided that this was not possible. Now it is reported by *The Times* that a new scheme is being put forward for the erection of a factory at Holywell, North Wales, where the necessary limestone is said to be available. It is apparently proposed to combine carbide production with the low-temperature distillation of oils from the bituminous coal found in the area. The surplus fuel produced by the distillation process would be used for the production of power at a low cost. The scheme has been submitted to the Government Committee which is inquiring into the question of carbide production.

The Basis of Tariffs

ARTICLES that have appeared in our own columns as well as papers that have been read before technical associations during the past few years indicate a growing realism of outlook on questions of electricity supply tariffs. This attitude is to be contrasted with the earlier habit of thought which regarded a tariff as "equitable" if it reflected as faithfully as possible the costs of production, when the only concession to the wish of the consumer to be charged by an understandable method was the statutory and non-load-inducing flat rate. Even then the methods of working out the incidence of production costs on tariffs was usually more than doubtful. Fourteen years ago we published a book by Mr. H. M. Sayers which was outstanding in its clear exposition of the main factors in tariff making. In this issue Mr. Sayers reviews the more elaborate new work of Mr. D. J. Bolton, which analyses the relationship between costs and tariffs on the basis of common-sense economics. Although costs and tariffs are by no means the same thing, a thorough knowledge of everything involved in costs is essential if full use is to be made of them to devise tariffs which are both profitable to the undertaking and acceptable to consumers, at the same time encouraging them to use more electricity.

Shannon Side-line

ONE of the least common "allied" industries is that carried on by the Eire Electricity Supply Board as part of its Shannon hydro-electric activities. Recently the acquisition of the principal fresh water and estuarine salmon fisheries has been completed. By the end of this year the work of re-establishing the valuable rod fisheries at Castleconnell will have been finished and a salmon catching weir near Limerick is expected to be ready by the 1940 fishing season. The Board has built a new eel weir at Killaloe and has also erected a hydraulic device at the base of the Ardnacrusha dam to lift the fry up the head race. Under the Shannon Fisheries Act, 1938, it has further obtained powers to develop oyster beds. At the moment the Board's fisheries are not a paying proposition, but of course there is always the opportunity to endorse anglers' permits, "Cook your catch electrically," and thus foster the Board's major business of selling electricity.

LIGHTING

In preparation for the coming lighting season the

"ELECTRICAL REVIEW"

of September 2nd will be devoted largely to various aspects of lighting. Experts will contribute special articles upon the technique and economics of the subject.

An E.D.A. Appointment

IN view of our frequent exhortations to the electrical industry to maintain the closest relationships with architects and builders (not that we claim originality for the idea), we are pleased to see E.D.A. advertising for a liaison officer. Applicants for the position must be qualified electrical engineers, competent to advise architects and builders regarding the electrical installations and equipment of buildings. The right man should be a valuable addition to the E.D.A. staff. In the same connection it is pleasing to see that E.D.A. is again taking a prominent part in the Building Trades Exhibition at Olympia next month.

London J.E.A. Finance

IT will be recalled that the Electricity Commissioners recently asked the London and Home Counties J.E.A. to "balance its budget" by the end of 1940 instead of in 1942, as the Authority had decided. This, it was held, would mean increasing the charges to consumers, with a probable adverse effect upon the development of the system. The matter is receiving the attention of the Authority's Finance Committee, but consideration has been deferred pending the report of a special sub-committee which has been set up to investigate costs. It is to be hoped that this sub-committee will find means of reducing the expenditure to avoid the unpleasant alternative of higher charges.

A Comparison

WHILE we may be dissatisfied at the recent tendency of the upward movement of electricity consumption in this country to slacken, we can perhaps derive a certain amount of cold comfort from the fact that in the United States the 1938 figures have, so far, been well below the previous year's levels. The latest available totals for the whole of the country show a decrease of about 9 per cent. from the 1937 figures. The slump in the Rocky Mountain mining region and the central industrial area is largely responsible.

An Industrial Research Laboratory

Electrical applications to testing, and the testing of electrical equipment

BY the courtesy of Dr. W. T. Griffiths, manager of the Research and Development Department of the Mond Nickel Co., Ltd., we were recently able to gain during a visit to the company's new research laboratories at Birmingham impressions of two-sided interest to the electrical engineer, for while much of the laboratory equipment is electrical in character a good deal of work is done in the testing of materials for use by electrical manufacturers.

Nickel is used by many different industries and it may be a component of alloys with such widely varying characteristics as good mechanical properties, malleability, corrosion resistance, optimum magnetic properties, constant coefficients of expansion or electrical resistance and susceptibility to heat treatment. The laboratory has been established to meet the continually increasing demand for more exact data and for improved alloys, occasioned by the growing severity of engineering requirements, as part of the policy of the company in developing its business by means of the industrial application of the results obtained from a careful study of the properties of nickel and its alloys.

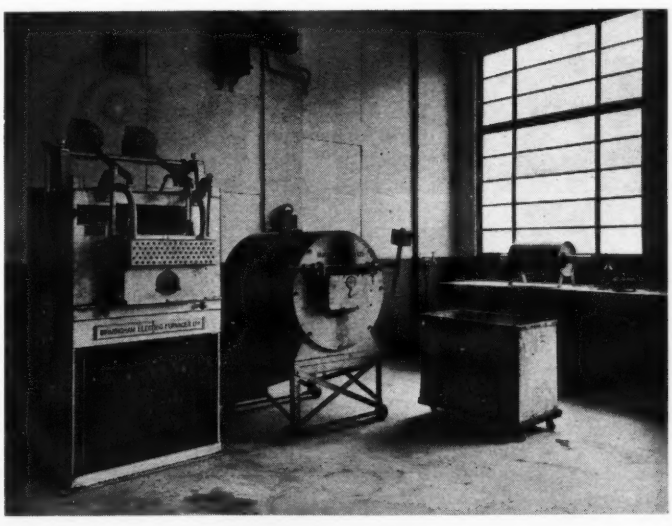
Left: Valve-operated high-frequency furnace. Centre: Welding operations in semi-technical department, showing specially controlled m.g. set in background. Right: Special switchboard for alternative supplies to power points in general section

Of particular electrical interest are the general and physical sections in which special arrangements have been made to make an unusual flexibility of electricity supplies available to the various equipment "set-ups." The power supplies for both sections are brought together on a switchboard where connections are made by means of plugs and sockets.

Each bench supply can be connected in a few moments to one of the variety of power supplies, including d.c., a.c. at several voltages, controlled-voltage a.c., or through a contactor which is operated by means of a Leeds & Northrup potentiometric controller and recorder. The last-mentioned supply is specially available for the electric furnaces, referred to later, and by means of this contactor outfit any one furnace may be held at constant temperature automatically. In the physical section there is a Hughes permeammeter which is used for magnetic testing and such equipment as Kelvin double bridges, Wheatstone bridges, resistance boxes and galvanometers for making determinations of electrical resistance and other physical properties.

In one of the life-testing laboratories there are sixty outfits of the Bash & Harsch type in which 12-in lengths of resistance wire are heated for two minutes, generally at a temperature of 1,120 deg. C. and switched off for two minutes, alternately, until "burn-outs" occur. Initially, supplies to the wires are set for the desired temperature and subsequently the voltage is held constant until failure takes place. The voltage is maintained constant by means of automatically operated regulators, one of which is of the English Electric type while the other is operated by means of Isenthal control gear.

In the second life-testing laboratory the tests are carried out under conditions approximating to those of the service to which the material under test is to be put. We saw various heating appliances under test which were wound with materials which had given interesting results in the more accelerated Bash & Harsch type of test. The 400-V three-phase lines are connected to a three-to-one 25-kW transformer and tappings from the secondary side of this are connected to a distribution board and, in turn, to the local supply contactors. Time switches are provided to control the contactors and for tests on domestic heating appliances they are operated on a thirty-minutes "on"-thirty-minutes "off" cycle. There were also tests under way to determine the current-carrying capacity of nickel and Monel flexible leads which are intended for use on electric heating appliances.



A pair of heat-treatment furnaces

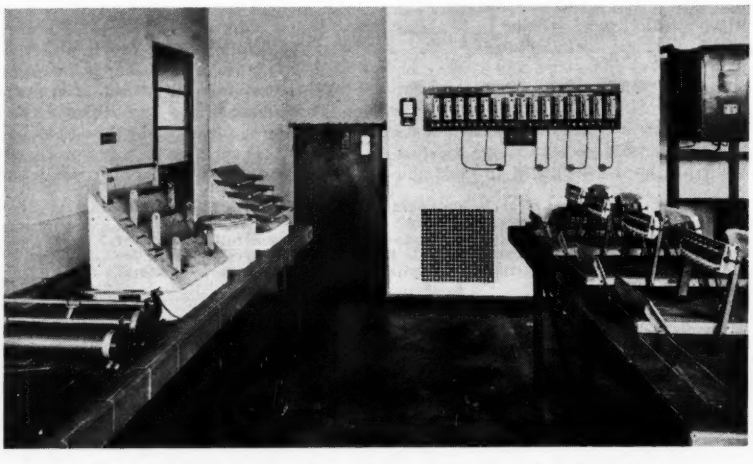
Apparatus for carrying out total immersion and alternate immersion corrosion tests may be seen in a main corrosion section. In the equipment for the former tests specimens are rotated within the corrosive liquor, the movement being carried out by means of electrically driven cranks. In the alternate immersion type of test specimens are alternately dipped into the corrosive liquor and held in the air. In both types of test the solutions are maintained at constant temperature by means of water baths with electric immersion heaters under thermostatic control. This department also contains a glass electrode for making determinations of the pH (acidity and alkalinity) of solutions.

In the electro-plating department research is being carried out on electrodeposition. The equipment consists of six large water baths with thermostatically controlled electric immersion heaters, and in each water bath there are six glass vessels

containing nickel plating solutions. Each vessel contains a centrally placed nickel anode surrounded by a sheet of nickel which serves for the cathode. The thirty-six electrolytic cells are electrically connected in series so that the current through each unit is the same.

In the semi-technical section of the laboratory a Murex d.c. motor-generator arc welding set (28 kW) is used for research on the welding of nickel alloys generally, including nickel steel, malleable nickel, Monel and nickel silver. The machine is arranged to allow control over the open-circuit voltage and arc voltage, and at the same time it is provided with an adjustment which permits control of the electrical characteristics of the generator.

There is also in this section an 18-lb. capacity 35-kVA high-frequency furnace supplied by the Electric Furnace Co., Ltd., which is used for the experimental production of high-melting-point alloys such as steels, nickel and nickel-chromium alloys. The melts are cast either as chilled ingots about 2 in. square and 12 in. long or as sand castings.



Corner of life-testing section: A group of radiant firebars on test

We saw in a special section a valve-operated high-frequency furnace produced by the Metropolitan-Vickers Electrical Co., Ltd., which is employed for making nickel alloys containing rare metals and also for melting operations in vacuum or under special atmospheres. The capacity of this equipment is 2 lb. and the furnace is loaded at 14 kVA. For use in connection with annealing and similar heat-treatment operations there are in a heat-treatment section of the laboratory two "Birlec" annealing furnaces with Leeds & Northrup potentiometric controlling gear. There is provision for quenching the treated articles in water or in oil.

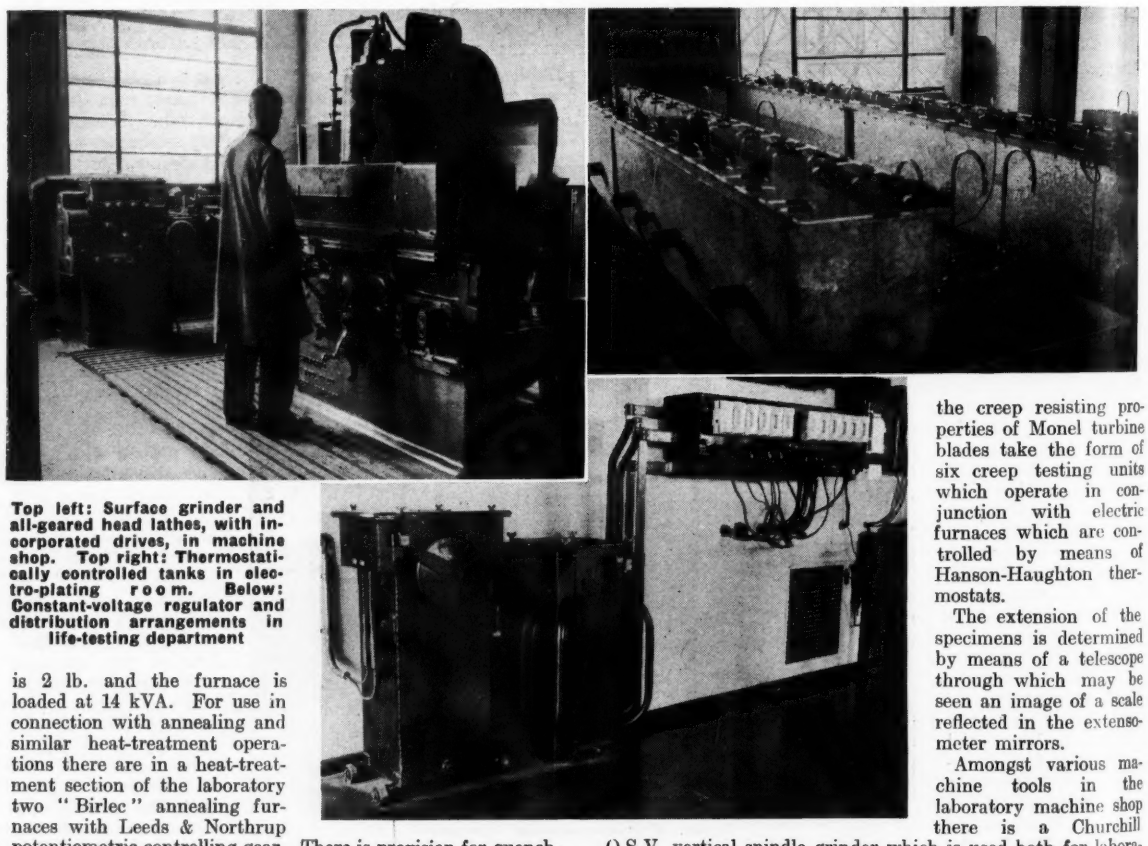
Both of these furnaces are wound with nickel-chromium alloy tape and they are provided with nickel-chromium alloy hearths. One furnace is of rectangular type with a hearth measuring 24 in. by 12 in. by 8 in. and the other equipment is of cylindrical design and has a hearth measuring 18 in. by 9 in. by 6 in.; the furnaces are loaded at 18 and 14 kW respectively. There are also in this section a number of small furnaces constructed in the laboratories from 2.5 in. diameter Vitreosil tubes which are wound with 80/20 nickel-chromium alloy resistance wire and contained in Monel outer shells. These small equipments are generally operated with special atmospheres, such as nitrogen and hydrogen, and are used for the heat treatment of small articles. In the adjacent thermal analysis department where the control panels for the heat-treatment furnaces are located there are a gradient furnace which can be raised and lowered by a small motor and a special thermocouple calibrating furnace, as well as a number of small electric furnaces designed specially for thermal analysis.

Amongst the various equipments which interested us in the mechanical testing section of the laboratory was a 50-ton Amsler universal testing machine in connection with which an electric motor drives an oil pump which passes oil through the dynamometer for measuring oil pressure and to the cylinder at the top of the machine which raises and lowers the cross head. The machine is used mainly for the breaking of tensile test pieces made from heat-treated nickel alloy steels, but it is also employed for tranverse tests on cast iron and for compression tests.

Apparatus at present in use in connection with studies of the creep resisting properties of Monel turbine blades take the form of six creep testing units which operate in conjunction with electric furnaces which are controlled by means of Hanson-Haughton thermostats.

The extension of the specimens is determined by means of a telescope through which may be seen an image of a scale reflected in the extensometer mirrors.

Amongst various machine tools in the laboratory machine shop there is a Churchill O.S.V. vertical spindle grinder which is used both for laboratory apparatus construction and for studies of the liability of hardened steels to develop cracks in grinding. There are also three independently motor-driven Churchill Redman 12 in. by 30 in. all-geared head lathes which are used mainly for the preparation of tensile test pieces. These machines are good examples of incorporated motor drives.

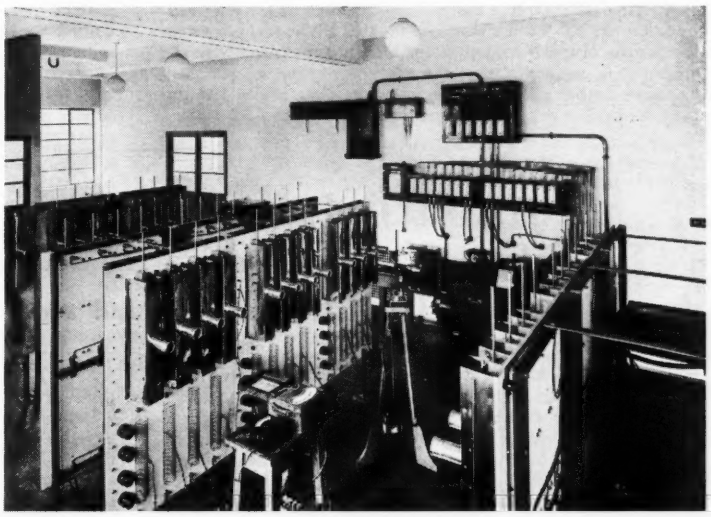


Top left: Surface grinder and all-geared head lathes, with incorporated drives, in machine shop. Top right: Thermostatically controlled tanks in electro-plating room. Below: Constant-voltage regulator and distribution arrangements in life-testing department

In the basement of the laboratory a number of fatigue testing machines of a design based on that employed in the National Physical Laboratory are at present employed for studying the influence of notches on the fatigue strength of heat-treated alloy steels.

By means of a Leitz universal dilometer which we saw in the metallography department a photographic record is obtained of the relationship between the dimensions and the temperatures of metal specimens. The apparatus is used largely four determination of coefficients of expansion and contraction in, for example, nickel-iron alloys and for studies of the transitions in alloy steels.

In the same section there is a Zeiss photomicrographic outfit which is used in connection with studies of the structures of various nickel alloys. The optical system consists, *inter alia*, of a d.c. arc, a condenser and a light filter, and the microscope is of the inverted type. Photomicrographs can be obtained with magnifications over the range of approximately 25 to 2,500 diameters.



A battery of "accelerated" lift-testing units at the Mond Nickel Laboratory

Apart from those instances where air conditioning is the medium for some form of "process conditioning" (industrial air conditioning) this, we think, is the first industrial laboratory we have seen sompletely equipped for (comfort) air conditioning. Fresh air is drawn through a preheater battery, an air washer and a reheater battery, and distributed through the building by metal ducts. The plant is designed to afford three to five chages of air per hour as required.

The temperature and humidity of the air are automatically controlled, and in warm weather a supply of well water at an average temperature of 53 deg. F. is automatically brought into circuit. Provision is made for air re-circulation during very cold weather. The heaters are normally fed by a steam calorifier. The fans are, of course, motor driven.

The electricity mains enter the basement where the main switchgear and distribution equipment are installed. Distribution to the upper floors is by sixteen vertical ducts constructed of rolled-steel sections and asbestos-cement sheets.

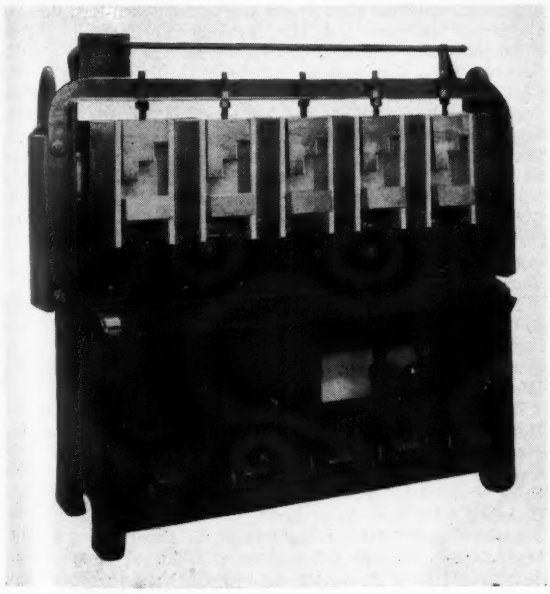
We are indebted to the Mond Nickel Co., Ltd., for permission to view the laboratory equipment and to take photographs, and to Dr. L. B. Pfeil, who, as assistant to Dr. Griffiths, is in direct charge of the laboratory, for his help in collecting the information on which this article is based.

Rivet Heating. By A. J. G. Smith

Some results achieved by electricity

THE electrical heating of rivets has given some very interesting results, and in certain works it is supplanting oil or solid fuel methods. Whereas the operation of rivet driving may be more or less intermittent, ordinary furnaces have to be kept practically in continuous operation, resulting in a heavy fuel consumption as well as wastage through overheated and burnt rivets. With an electric heater of the contact type energy is consumed only when the rivets are being actually heated.

In addition, it is almost unnecessary to labour the point that the fumes and gas given off by fuel-fired furnaces add considerably to the discomforts of a class of shop in which the working conditions are already sufficiently onerous. This is especially the case in winter when it is necessary to keep the shop closed as far as possible in order to guard against draughts of cold air passing through. The resulting fumes and smoke may be so heavy as to necessitate operations being discontinued for the time being owing to the overhead crane operators being unable to see signals from the ground.



Berwick type five-electrode rivet heater

A further limitation of both oil and gas heaters in this particular field is that such furnaces have necessarily to be permanently fixed at particular points on account of the pipe lines, which restrict rearrangement of the heaters to suit changed conditions of working in the shop. Electric heater connections, on the other hand, permit of a change of location being made much more quickly.

A rivet heater of a type now much used in the United States, manufactured by the American Car Co., of Berwick, Pa., has five electrodes stepped so as to accommodate rivets of varying lengths, which are inserted between the electrodes with the aid of a pair of short tongs and by pressing the foot pedal, which opens the electrode on the secondary circuit and allows it to be firmly held. Records have been kept during a period of two months in a works where this type of heater has just been adopted to show the time taken and the electrical energy consumption on heating up rivets of various sizes as used in different machines, with the results shown in the accompanying table. The consumption is equal to 13.9 kWh per 100 lb. of rivets heated, or 311 kWh per ton.

Rivet size.	Quantity.	Weight lb.	Type.	Heating time min.	kWh.
⅝in. × 2¾in.	25	14½	Bull	1.60	1.44
⅝in. × 2¾in.	25	14½	Gun	2.27	1.80
¾in. × 2½in.	25	16	Bull	1.86	2.16
¾in. × 2½in.	25	16	Gun	2.53	2.52
⅞in. × 3¾in.	25	21½	Gun	3.45	3.42
1in. × 3in.	25	25½	Bull	2.80	3.24
1in. × 3in.	25	25½	Gun	3.58	3.96
		133½		18.09	18.54

It is, however, one of the features of rivet heating that the results obtained on a trial run do not by any means correspond with the overall consumption over a lengthy period of working. A better opinion of the cost of electrical heating can, therefore, be formed from the overall results obtained in a structural steel works where forty-three heaters of this particular type are employed. In this establishment over a period of 250 working days over 11½ million rivets were heated, having a total weight of 3,754,706 lb., with an overall energy con-

sumption of 704,300 kWh, representing an average of 419 kWh per ton, or 18.7 kWh per 100 lb. of rivets heated.

Some results which have been secured in an American works producing heavy hopper type trucks are also of interest as showing the consumption for a considerable tonnage of rivets. In this case a record was taken over three days of the consumption and output of twenty-five heaters, the results being:—Total consumption over three days' operation, 9,580 kWh; consumption per day, 3,193 kWh; consumption per hr., 319.3 kWh; consumption per furnace per hr., 12.8 kWh; consumption per 100 lb. of rivets heated, 18.9 kWh; and consumption per ton of rivets heated, 423 kWh. In comparison with the foregoing, it was found that the oil consumption for precisely the same output of work in another section where twenty-seven oil-fired rivet heaters were used averaged 6.12 gallons per 100 lb. rivets. It is, of course, recognised both by users and by furnace makers that it is possible to heat up 100 lb. of rivets in a suitable oil-fired furnace with a very much smaller consumption than this, but the essential point in this class of work is that the 100 lb. of rivets thus heated *en bloc* could not be used immediately they were available, and it is precisely this necessity to keep pace with the requirements of the riveting gang that makes the consumption of the average oil-fired heater so high and the performance of an electric contact heater so striking. The fact that there are in the United States works each using 30, 43, and 50 heaters continuously will show that not only does electrical heating offer important advantages to the user, but that this branch of work can furnish a very useful industrial load for electricity supply undertakings in whose areas such work is carried on.

Illuminating Engineering Education

By J. B. Harris, Grad. I.E.E.

Requirements and suggestions

The modern illuminating engineer needs an equipment embracing many subjects. The author enumerates these, gives particulars of the courses now available and makes some proposals regarding qualifications.

THE status of the illuminating engineer is at present extremely vague and cannot, for the purposes of relative qualification, be compared with that of other specialists such as the chemcial engineer, heating and ventilating engineer or radio engineer. The term "lighting engineer" should indicate a man who has specialised in the theory and practice of illumination, including all types of light sources.

Just as when a bridge or a dam is to be constructed a consulting engineer is retained, so when a building is to be lighted the advice of a competent specialist should be sought. An attempt to illuminate a factory or office merely by reference to a catalogue of fittings will prove to any engineer that lighting application requires more than rule-of-thumb methods.

During recent years there has been an immense number of improvements in light sources and methods of light control. while lighting application has similarly taken on progressive and modern trends. All this has resulted in the need for specialised study, and hence for lighting experts. The illuminating engineer must have a varied amount of knowledge, dealing with the following variety of subjects: Mathematics, electrical technology, gas technology, engineering drawing, chemistry, physics, economics, physiology, psychology, art and architecture.

A lighting specialist must have some knowledge of the physiology of the eye and the relationship between light and vision, and also of psychological effects of lighting. There is increasing need for active co-operation between him and the architect, so that he will be able to appreciate the architect's point of view and produce pleasing results.

What qualification is there, in the form of a certificate or membership of a recognised body? A lighting expert is not necessarily a member of the Institution of Electrical Engineers. The most prominent organisation dealing with lighting matters is the Illuminating Engineering Society, which is open to all who are interested in lighting, but at the moment no standard of knowledge is required for admission. It is therefore a very welcome move on behalf of the City and Guilds Institute to award certificates in illuminating engineering. The regulations and syllabus have been adopted on the recommendation of the Advisory Committee on Illuminating Engineering and will come into operation in the session 1938-1939. For the purpose of awarding certificates, the subject has been divided into two grades, intermediate and final, the latter being sub-divided into two sections A and B.

Students taking the intermediate course must have some fundamental knowledge of allied subjects, and the City and Guilds Institute recommends a certain standard of education in mathematics, drawing, electricity and physics. The intermediate grade consists of six main sections, dealing with the subject in a comprehensive manner. The first section covers light as a form of radiant energy requiring a study of the spectrum. Included also are the methods of controlling light by reflection and refraction. All this will be treated in a general way and will serve as a sound basis for more specific study in the other sections. The second section deals with the physiological side, and shows the relationship between light and vision. The knowledge of the sensitivity of the eye to light of various wavelengths and of the variation of visual acuity with illumination intensity is important, especially in industrial lighting. The "inverse-square law" must be clearly understood, and this, together with fundamental terms and instruments for measuring light and polar and isocandle diagrams, are included in a third section. A fourth section deals with light sources. A study of daylight is required, together with artificial light sources such as electricity, gas and oil, while familiarity with the properties of glassware in relation to light distribution is called for.

Before lighting schemes are planned, the engineer must have a knowledge of recommended illumination values, British Standard Specifications, general systems of lighting, architectural influence and the objects to be achieved in planning installations, such as are included in Section 5. In this connection illumination values for a large variety of interiors are published in the form of a recommended code by the Illuminating Engineering Society, and specifications on general service lamps, glassware and street lighting by the British Standards Institution. In the last section a descriptive treatment of gas and electricity distribution schemes and of control apparatus is included, together with costing of various lighting methods and tariff schemes.

A certificate based upon this syllabus will be a good qualification for the engineer who has decided to specialise in illumination. For the final grade the candidate must have passed the intermediate examination, and the subject matter deals in a more advanced manner with that covered by the first certificate. The obtaining of either of the final awards will be more beneficial to the lighting engineer who has specialised in a particular branch of the subject.

On the instruction side, American progress has been much more rapid than in this country. There are regular courses in illuminating engineering at a number of American universities, one entitled "Illumination of Buildings" being intended for architects and designers. The E.L.M.A. Lighting Service Bureau does very good work in this respect by its series of short courses. During the past year lectures on illuminating engineering have been held at the South-East London Technical Institute and the Borough Polytechnic. Both these institutes will hold courses during the coming session, designed to comply with the City and Guilds syllabus. The South-East London Technical Institute is arranging a three-year course leading up to the first award. The first two years deal with ancillary subjects, such as physics, mathematics, drawing and technical electricity, and the third year is devoted to mathematics and illumination. The lectures will be illustrated by lantern slides and demonstrations. For students living in parts of the country where there are no technical institutes, a correspondence course in illuminating engineering is being arranged by the British Institute of Engineering Technology.

There is a large number of possible openings for qualified men on the staffs of manufacturers of lamps and lighting fittings, consulting engineers, public lighting authorities or supply undertakings, Government departments, research laboratories and electrical contractors.

Regarding recognition of status, it is suggested that the Illuminating Engineering Society might revise its membership grades so that holders of City and Guilds certificates could describe themselves as associate members, full membership being granted to more experienced men. The system might be based upon that of the Institution of Electrical Engineers, a grade of membership being formed for those having a lighting interest although not possessing technical qualifications. This would be a good step as a preliminary to obtaining a charter and possibly registration.

Power Stations of the Future

By D. H. Parry, B.Sc., A.M.I.E.E.

The effect of increased domestic load

IT seems reasonable to estimate that in ten years' time the number of kWh sold for domestic purposes will amount to 70 per cent. of the total, and will, therefore, form the predominant load on the generating station. The bulk of the domestic load may be expected from cooking, space heating and water heating. The first of these is responsible for a sharp peak demand at midday and on Sundays, and in the next decade it will have reached such dimensions as completely to overshadow peak loads from lighting and other services.

Taking as an example an undertaking supplying 136 million kWh with a maximum demand on the generating station in the year ended March, 1937, of 55,000 kW. For the year ending March, 1947, it would be necessary to estimate for a supply of 400 million kWh with a maximum demand of 185,000 kW, whereas if the load factor remained the same, the demand would only be 160,000 kW.

Likely savings in the fixed costs of generation during the next ten years are considered in conjunction with the fall in load factor which the cooker peak may bring about.

At the present time peak load plant carries 20 per cent. of the total maximum demand and generates only 1 to 2 per cent. of the total kWh and is selected from obsolete plant. To meet the growth of the cooker peak during the next decade peak load plant must be provided to carry 50 per cent. of the maximum demand and to generate 15 to 20 per cent. of the total kWh.* Such plant, by reason of its size, special conditions of running and high efficiency, is expensive, and it is necessary to inquire what capital expenditure would be involved and what the effect would be on the costs of generation.

Cost of Production

The grid tariff used for the sale of electricity by the Central Electricity Board to supply undertakings is approximately £3 per kW of maximum demand and 0.2d. per kWh. As it is intended to represent the average cost of production at selected generating stations taken over a number of years, it will be found that most generating stations produce at a cost very similar to this. The costs of production may be lower because of peculiar advantages of position or conditions of working, but as load increases distribution costs must be added to production costs until it becomes more economical to generate on a less fortunate site. It appears a reasonable assumption that the grid tariff represents the cost of production at a hypothetical generating station, giving a universal supply and having no special advantages in its access to cheap coal, abundant water supplies and important loads.

The running cost of producing electricity is almost entirely the cost of coal consumed. At present peak load sets generate only 2 per cent. of the total kWh at a thermal efficiency approximately half that of base load sets. It follows that the cost of producing peak load units increases the average running cost by approximately 2 per cent.

If the proportion of kWh generated by peak load sets were increased to 20 per cent., running costs would also be increased by 20 per cent. and a further increase would be necessary if the kWh were generated under adverse conditions, such as short periods of running and high circulating water temperature. There is, however, no fundamental reason why the thermal efficiency of peak load plant should be so low, and if capital expenditure permitted there would be no difficulty in securing an improvement of 20 per cent. in the average thermal efficiency of generating stations even with a reduced average load factor.

The fixed charge of £3 per kW of maximum demand covers not only capital but also all overhead charges in the generating station. The overhead charges, in addition to such items as rates and management, include a considerable portion of the cost of salaries, wages, repairs, maintenance and coal, it being assumed that the station must have a permanent staff and incur no-load losses that are independent of the number of kWh generated. The amount of these items will represent approximately one-third of the fixed charge.

Capital Costs

It is apparent that capital charges of the hypothetical generating station amount to approximately £2 per kW of maximum demand which corresponds to a capital outlay of £30 per kW of output or, say, £27 per kW generated after allowing for losses, or £22 per kW of plant installed after allowing for spare plant. Of this outlay turbo-generating plant would cost £4.5, boiler plant £6, and cooling towers £1.2, giving a total of £11.7 per kW for plant only. This is only 53 per cent. of the cost of the station, the remainder being accounted for by site value, foundations, buildings, auxiliary plant, switchgear and works of a general nature.

It will at once be seen that the capital charges on the actual generating plant are responsible for only one-third of the fixed charge per kW of maximum demand. In inquiring how the fixed charge may be affected by increase of load, it is of greater importance to study the effect on the remaining two-thirds, not forgetting that the design of the plant is the governing factor.

The cost of the general works of a generating station is so dependent on local conditions and on the skill of the power station designers that no exact rules for estimation can be laid down. Nevertheless, if we examine the site of a typical generating station of, say, 100,000 kW capacity, we find that the area occupied by buildings housing the actual plant may occupy only one-eighth of the area, whereas cooling towers may occupy one-fifth, and the coal pile one-quarter or more. The size of the coal pile will vary directly as the number of kWh generated and inversely as the thermal efficiency; the size of site occupied by cooling towers will vary directly with the maximum demand and inversely as the thermal efficiency. It might be expected that the cubic capacity of buildings would vary directly as the installed plant capacity, but improvements in thermal efficiency and engineering skill make possible very large increases of plant capacity on the same site area.

Effect of Size of Plant

At the present time the average of a generating station is about 70,000 kW and the size of turbo-alternator units 15,000 kW, but in ten years' time the average size of station will be 200,000 kW and the size of the generating units 50,000 kW.

For a given set of steam conditions the cost per kW of a 50,000-kW set would be 15 per cent. less than that of a 15,000-kW set, and the cost per kW of a 300,000-lb.-per-hr. boiler would be nearly 20 per cent. less than that of a 100,000-lb.-per-hr. boiler. It would not be necessary to construct a building of three times the volume to house the larger plant because the plant occupies such a small part of the cubic contents of the buildings. It would be reasonable to expect a saving in building cost per kW for the large power station of at least 15 per cent.

In cooling towers, very large savings in the ground area and cost per kW have been obtained by building concrete towers of large size and, apart from improvement in design, a reduction of 25 per cent. in cost per kW can be made by doubling the size of tower.

In the case of the coal pile no appreciable saving could be expected from increase of size unless accompanied by increase of efficiency. In the case of other items of fixed costs, such as salaries, wages, repairs and maintenance, experience shows the probability of considerable falls in the cost per kW with increase of unit size; a 50,000-kW set requires scarcely more labour to operate or maintain than a 15,000-kW set, or similarly a 30,000-lb.-per-hr. boiler than one of 100,000 lb. It appears reasonable therefore to anticipate that the cost per kWh for the items enumerated will be halved during the next ten years.

Simplification of Plant for Peak Load

If it were decided to install simple inexpensive plant to meet peak loads, the turbines might be designed for a lower efficiency, a worse vacuum and reduced feed heating. The boilers might be designed for low pressures and temperatures and for a high stack temperature. A variation of one condition so affects another that it is only possible to consider one case at a time.

Thus, consider a 30,000-kW turbine designed for three-stage feed heating and a 28.4-in. vacuum, and for comparison reduce the feed heating to one stage, cheapen the turbine to give the same output at a vacuum of 28.2 in. and utilise the same condenser and cooling tower.

Heat consumption would be increased by 7¼ per cent., requiring boilers of 7¼ per cent. greater capacity. The cooling tower would have to reject 4 per cent. more heat and, incident-

* See I.E.E. *Journal*, Vol. 82, No. 493. East Midland Sub-Centre, chairman's address by the author.

ally, would require 4 per cent. more make-up water. Relative costs would, therefore, be as follows:

DAY-LOAD SET.		PEAK-LOAD SET.	
Generating plant ...	£4.0	Generating plant ...	£3.0
Boiler plant	£5.2	Boiler plant	£5.6
Cooling tower	£1.0	Cooling tower	£1.0
	£10.2		£9.6

The saving in cost of the cheaper machine is only 6 per cent., which will be partly off-set by the increased cost of larger boiler building, a larger coal pile and the capitalised value of the increased coal consumption. Thus, simplification offers little saving in the cost of peak-load plant, and the fixed cost of generation cannot be appreciably reduced by building cheap peak-load plant. It is necessary to inquire how the fixed cost of generation from average plant may be reduced and it may be found that an increase in the capital expenditure on boiler and turbine plant to permit the use of higher steam pressures and temperatures is justified.

Effect of High Pressures and Temperatures

Supposing it is concluded that sets of 40,000 kW are necessary, the following is a comparison of capital costs of low-pressure and high-pressure plant:—

Turbo-alternator plant of 40,000 kW designed for 350 lb. per sq. in. and 800° F with a 28.4 in. vacuum	£3.8
Boiler plant 480,000 lb. per hr. (20 per cent. spare) at 8s. 6d. per lb. of steam	£5.2
Cooling towers	£1.0
	£10.0
Turbo-alternator plant of 40,000 kW designed for 1,500 lb. per sq. in. and 850° F with a 28.4 in. vacuum	£4.1
Boiler plant 360,000 lb. per hr. (20 per cent. spare) at 14s. per lb. of steam	£6.3
Extra cost of steam and feed pipes, etc.	£0.5
Cooling tower	£0.7
	£11.6

The cycle efficiency of the generating sets would be 30.7 and 36.7 per cent. and, allowing for the usual losses, the overall efficiency on a good plant load factor would be about 24 and 28 per cent. The cooling towers for the high-pressure plant would only occupy 70 per cent. of the space and require 70 per cent. of the make-up of those for the equivalent low-pressure plant. The boiler plant of the high-pressure plant would consume only 85 per cent. of the coal of the low-pressure plant, and the space occupied by such bulky items as the coal store and electrostatic precipitators could be reduced by 15 per cent.

The 40,000-kW low-pressure turbine just considered is getting near the limit of size at a speed of 3,000 r.p.m., but the high-pressure turbine of this size has an exhaust end only as large as a 30,000-kW low-pressure turbine. Thus a 50,000-kW high-pressure set could be installed in almost the same space and cost per kW as the low-pressure 40,000-kW set.

It emerges that in a large station of, say, 200,000-kW capacity the number of generating sets may be reduced by 20 per cent. by adopting high steam pressure. Sets of 50,000 kW running at 3,000 r.p.m. are not sufficiently developed at present to show a saving in capital cost per kW, but the reduction in the number of sets would permit a saving in the cost of turbine house buildings of at least 15 per cent.

The total effect of adopting high efficiency plant is that the kW cost of plant is increased by 16 per cent., but the cost of buildings, site, coal pile, and other works is reduced by 15 per cent. The effect on the fixed cost of wages and salaries, repairs and maintenance, cannot be easily judged. The improvement in range and quality of engineering materials is so rapid that renewal costs continue to fall despite the heavier demands made by higher pressures and temperatures. The increase of unit size made possible by higher efficiency and the reduced consumption of fuel both tend to reduce the cost of operating and maintenance, wages and salaries.

The fixed costs of the present average power station of 70,000-kW capacity are as follows:

Capital charges on plant	£1.06 per kW	
Capital charges on auxiliary works, building and site ...	£0.94	,,
Fixed charges on salaries and wages, repairs and maintenance	£1.00	,,
Total	£3.00	,,

The fixed costs of the average power station of ten years hence, assuming 200,000 kW capacity and high efficiency plant, are as follows:

Capital charges on plant	£1.06	
Reduction for increased size of unit, 15 per cent. ...	£0.16	
		£0.90
Increased cost for high efficiency, 16 per cent.		£0.14
Net cost		£1.04
Capital charges on auxiliary works and buildings ...	£0.94	
Reduction for increased size of unit, 15 per cent. ...	£0.14	
		£0.80
Reduction for increased efficiency, 15 per cent.		£0.12
Net cost		£0.68
Fixed charges on repairs and maintenance and salaries and wages	£1.0	
Reduction for increased size of unit	£0.5	
Reduction for increased efficiency	—	
Net cost		£0.50
Total cost per kW ...		£2.22

These approximate calculations have been based on average plant, but it may be thought that now or in the next decade peak loads could be met by using plant more than twenty years old on which no capital charges have to be met. Present experience shows that such a possibility is a remote one. Ten years ago the grid was not in operation and there was a large excess of spare plant. To-day the Central Electricity Board has effected a large reduction in the proportion of spare plant and there has been a general improvement in load factor.

Peak-load plant is required for about 20 per cent. of the maximum demand, and there ought to be in existence to meet it at least sufficient plant more than twenty years old. Nevertheless, nearly all peak load is carried on plant less than twenty years old. The reason is simple; the units of twenty years ago are too small to be worth putting into operation and even plant fifteen years old is so expensive in operation and maintenance that it is retained merely because the loan period has not expired. It may be confidently predicted that the units installed ten years ago will also be too small to be worth running in the power station of 1948, and it is wrong to assume that in any event peak loads could be met by plant carrying no capital charges.

Reduced Load Factor

From the foregoing considerations it emerges that given a threefold increase of units in ten years and by taking full advantage of modern design using the largest and most efficient sets a fall in the fixed charge component of 28 per cent. may be forecast. This would permit a fall in load factor of 28 per cent. without any extra fixed cost of generation. The author only envisages a fall of 16 per cent., so that even if no methods of improving load factor are devised to counterbalance the cooker peak it should be possible to avoid any rise in the cost of generation.

It is possible to reduce the fixed costs of generation by building large and efficient plant, but the engineer has not yet learned how to design peak-load plant with sufficiently small capital expenditure to be worth installing. Probably he never will and so-called "peak-load plant" will always be unprofitable and will be replaced as soon as possible.

It is of interest to inquire whether the best use is being made of the grid when making extensions by the installation of the largest and most efficient type of plant and, finally, whether proper consideration is being given to methods of securing load diversity and improvement of load factor.

The Oxford Undertaking

The chairman of the City of Oxford Electricity Supply Department (Dr. H. T. Gillett) has sent us a booklet entitled "Some Considerations on Electricity Distribution in the Light of the Proceedings before a Select Committee of the House of Lords." This outlines the circumstances in which the Oxford Corporation promoted a Bill for the purpose of acquiring the remainder of the Oxford Electric Co.'s undertaking and its rejection by a House of Lords Select Committee. It aims at showing that the Corporation could have supplied electricity in the rural area adjoining the city at lower rates than the Wessex Electricity Co., which purchased the Oxford Co.'s undertaking. Incidentally it deals with the financial structure and operations of Edmundson's Electricity Corporation which controls the Wessex Co., as it did the Oxford Co. In view of the impending legislation dealing with electricity distribution the question is asked whether holding companies are to absorb the urban areas which are at present under municipal management or whether the local authorities are to supply adjacent rural areas which are at present under holding companies.

I.E.E. North-Eastern Students' Outing

The North-Eastern Students' Section of the I.E.E. is arranging a summer outing on Sunday, August 14th, ladies being invited. The party will travel by motor-coach to Housesteads on the Roman Wall, and a visit to Borcovicus Camp and Museum is planned. Tea will be provided at Brampton, and the coaches will return *via* Haltwhistle, Haydon Bridge and Hexham.

Full particulars of the arrangements may be obtained from Mr. A. E. Shearer, 1, Elm Terrace, The Green, Wallsend-on-Tyne.

Crompton-Parkinsons and the E.I.B.A.

The sum of £20 has been received by the Electrical Industries Benevolent Association from Mr. Frank Parkinson, being a collection made by the employés at the recent diamond jubilee celebrations of Crompton Parkinson, Ltd., as a mark of appreciation for what the company is doing for the welfare of its workers.

Costs and Tariffs. By H. M. Sayers, M.I.E.E.

Their interaction in electricity supply

IN his recently published book* Mr. D. J. Bolton has put together an analysis of costs and a synthesis of tariffs based upon that analysis and upon the general relations between price, supply and demand, as modified by the legal position of the supply undertakings in this country. The author has compared types of tariffs in use showing how they meet the requirements or fail to meet them. It is a valuable contribution to the literature of the subject, affording reliable guidance for the construction of tariffs.

Starting with the effect of the interaction of supply and demand in settling prices, the author points out that in the long run the total receipts for electricity must pay the total costs and must represent value for money to the consumer. In a free market the effective demand rises as the price falls, the effective supply rises as the price rises and *vice versa*. Plotting demand and supply against sales the price tends to settle at the point where the two curves intersect. This settled price is the marginal cost at which the last article is produced, and also the marginal price at which the last article is sold. The reactions of demand, supply, and price, form a chain, the price at any time being in unstable equilibrium, self-adjusting though usually with a time lag. In a freely competitive market marginal cost=mean price=marginal utility. Laws involving human volition, however, have not the immutable character of physical laws; they only express a general trend.

With a monopoly of electricity supply, on the other hand, the curve of supply costs against sales will probably be nearly straight with a slight downward trend, *i.e.*, the marginal or incremental cost of additional sales at any point will not be very different from the mean cost. The demand curve—units saleable against price—retains the features of falling and rising in some inverse relation to the price. The monopolist producer can fix any price he chooses and will tend to fix it at a level which will yield the largest margin of profit. Actually that tendency is controlled by legal restrictions.

The "value for money" to the consumer depends upon what use he desires to make of the energy, having regard either to the cost of equivalent service, or to the strength of his desire—and his ability to pay for—service or amenities not obtainable otherwise. The potential demand against price curve gives the total revenue, and the supply against costs curve gives the total costs; the difference between these two areas is the curve of marginal (profit) revenue. Hence the supplier can see what price will yield the maximum profit if he can forecast the demand-price curve.

The original conception of the proper electricity supply tariff as "what the traffic would bear" has been proved to be a fallacy. The book reviewed in this article shows why this is the case and examines the factors which enter into the matter

The demand for necessities does not increase steeply with falling prices, but if the price of luxuries falls sales are likely to go up sharply. The demand curve for necessities is therefore "inelastic" while that for luxuries is "elastic." "Elasticity" is defined as the ratio between a percentage drop in price and the consequent percentage rise in sales or as the reciprocal of the slope of the demand curve. Thus the more nearly essential the services conferred by electricity the more nearly vertical will be the demand curve and the higher should be the price.

"Necessity" and "Luxury"

Industrial power and domestic and commercial uses account for over 90 per cent. of the total demand for electricity. The first is fairly uniform, the second is made up of many uses which compete at very different price levels. The author splits it into a high-value "necessity" portion, *e.g.*, lighting, cleaning, wireless; and a "luxury" portion, *e.g.*, heating and cooking, which, being subject to competition, is therefore low-valued. Lighting and heating have rather different characteristics.

The author has analysed the relation between the prices and the sales for domestic purposes per head of population of a large number of undertakings selling over 10 million kWh per annum. One of his curves represents the average sales per head against price, an average cost of production (1.2d. per kWh) and the incremental or profit revenue for each level of price. The demand line would cut the supply line at 420 kWh per head per annum; that price of 1.2d. therefore would yield the largest sales possible without loss; the point of maximum profit is at 1.6d. with a consumption of 200 kWh per head per annum. But at about 110 kWh and a price of 2.3d. the profit becomes nil; at lower consumptions and higher prices a loss results. Hence, high price and low consumption per head indicate "necessity" uses; reduction of price in this region increases losses, unless it is sufficiently drastic to attract the "luxury" uses.

Figures obtained from separate metering of lighting and heating in Hampstead for fourteen years give relative elasticities of 1.06 for lighting and 1.8 for heating, each expressing the ratio of percentage changes in price and consumption per consumer. Taking the ratio of price and consumption changes over the whole country, the elasticity of domestic demand is shown to have been due rather to increases in the number of consumers than to increased individual consumption. A similar analysis of consumption for industrial power, based upon the number of insured workers, gives a relative elasticity of 1.42.

An important practical conclusion is that reductions in the lighting rate or in the fixed portion of an "all-in" tariff are never justified; they amount only to a distribution of surplus. Far more justifiable and profitable are reductions in the "follow-on" rates.

An Ingenious Diagram

Graphs of costs in which £ per kW and pence per kWh are ingeniously represented in a novel diagram, on such scales for the money ordinates that the total ordinate at any point—at the generating station, sub-station or consumer's terminals—gives the cost in the two-part form of £ per annum per kW plus pence per kWh, or, at a given load factor, the overall pence per kWh delivered, bringing in the effects of diversity factor and losses. This cost analysis does not cover such items as laying services, meter reading and book-keeping, which can be approximately covered by inclusion in the "fixed charge."

The fixed costs of electricity supply are very high relatively to the running costs. For example, in the average grid tariff (which may be regarded as based upon generating plus transmission costs) the ratio is about sixteen to one. A consumer's two-part tariff, including distribution costs and allowing for a diversity factor of 1.6, would be £10 per kW plus 0.25d. per kWh. The ratio would then be 40, *i.e.*, 10/0.25. Actual two-part tariffs show much lower ratios because the use of such ratios as pertain to costs would be unpopular. The persistence of flat-rate tariffs, although only one-eighth of the costs are proportional to kWh, and of low-ratio two-part tariffs show that they can meet producers' costs.

Of the industrial tariffs offered by undertakings selling over 10 million kWh per annum, 53 per cent. are of the two-part and "disguised" two-part kind; block rates based on quantity alone form 47 per cent. The two-part method, broadly a maximum demand or Hopkinson tariff, is on the whole a "costs" tariff representing production value, whereas the block rate is a "sales" tariff. The m.d. tariff gives some advantage to the large consumer, the block tariff gives far too much advantage. In practice industrial tariffs are framed with some regard to what it would cost large consumers to generate their own supply. The author's conclusion is that a block rate for small consumers and a Hopkinson rate for large ones best serve the purposes of an industrial tariff. He admits adverse opinions and suggests the block-rate plan dependent upon installed capacity, as recommended by the 1930 Committee's report on the "Uniformity of Electricity Charges and Tariffs," as an acceptable alternative for small industrial loads.

For domestic tariffs, 82½ per cent. of the undertakings offer separate flat rates for domestic lighting and for domestic cooking and heating; 90 per cent. offer alternative two-part ("all-in") tariffs; and 12 per cent. "disguised" two-part tariffs ("all-in block rate tariffs"). Only 6 per cent. offer the pure quantity block rate. The m.d. tariff has disappeared from the domestic field. The fixed-charge part of the all-in rates is based upon a sort of residential qualification—mostly upon rateable value. It is not an "m.d. disguised" tariff. The net result of an examination of the uses to which electricity is or can be put and of alternative means of obtaining similar services leads to less attention being paid in domestic tariffs to costs and more to selling considerations.

Actually the fixed charge is a payment for lighting service having a very high sales value out of all proportion to its energy content. But a lighting load is an expensive one to supply because of its low load factor; so the high rate of either specific lighting prices or the concealed price represented by the fixed charge of the all-in tariffs has some justification from the costs side. The load factor of cooking or heating equipment in a single house may not be very different from that of a single lamp in the same house, but the diversity factor among a group of similar houses will be much higher. Hence a justification from the costs side for the lower "follow-on"

*"Costs and Tariffs in Electricity Supply." By D. J. Bolton. Pp. 214; illus. Chapman & Hall, Ltd., 12s. 6d.

Corrosion of Steel Chimneys. By J. N. Waite, M.I.E.E.

Cause and prevention

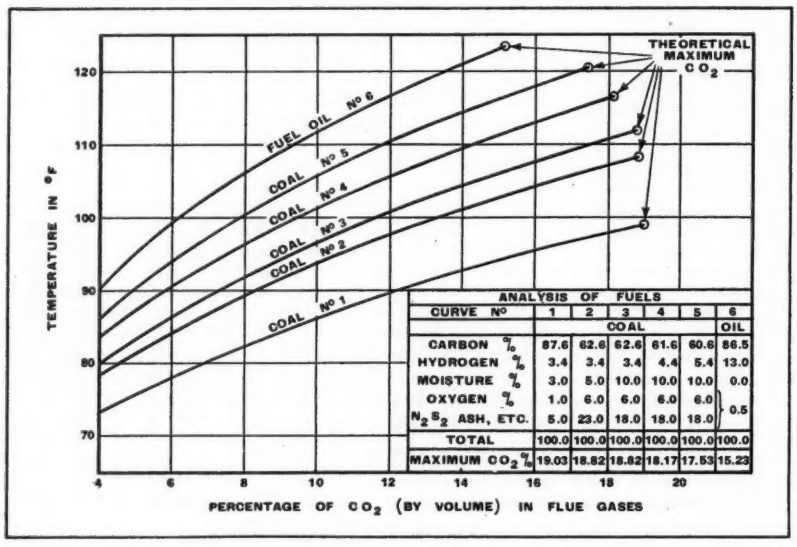
Describing a new method of construction which he tried at Hull, the author says there is good reason to believe that this will result in steel chimneys having a life as long as the plant they serve

RECENT years have seen the steel chimney fall into disfavour for modern power plants, and brick or ferro-concrete ones come into favour. This despite the fact that the steel chimney had many advantages such as low first cost, and low weight which enabled it to be carried on the structural steelwork of the boiler. The real cause of this reversion is the rapid internal corrosion which occurs with chimneys attached to high efficiency boiler plant.

Effect of Increased Efficiency

This corrosion problem was brought prominently to my notice some few years ago, when five steel chimneys attached to five separate boilers at the Hull power station were found to be corroded so severely as to be unsafe, and had to be renewed within four or five years of being put into service. The chimneys were carried on the structural steelwork of the boilers and the arrangements were such that the only possible way was to replace the chimneys by other steel chimneys. The prospect of having to do this every few years caused me to devote some attention to the problem of ensuring a longer life for the proposed new chimneys.

Other steel chimneys at the same power station, on older and less efficient boiler plant, had lasted for nearly twenty years, and it appeared reasonable to assume that the rapid corrosion experienced with the new chimneys was related in some way to boiler efficiency. As soon as the problem was analysed from this point of view, the cause of the rapid internal corrosion became apparent and a method suggested itself guarding the chimney against the deleterious effects thus experienced.



ANALYSIS OF FUELS

CURVE No	1	2	3	4	5	6
	COAL					OIL
CARBON %	87.6	82.6	82.6	81.6	80.6	86.5
HYDROGEN %	3.4	3.4	3.4	4.4	5.4	13.0
MOISTURE %	3.0	5.0	10.0	10.0	10.0	0.0
OXYGEN %	1.0	6.0	6.0	6.0	6.0	0.5
N_2S_2 ASH, ETC.	5.0	23.0	18.0	18.0	18.0	
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
MAXIMUM CO_2 %	19.03	18.82	18.82	18.17	17.53	15.23

Fig. 1.—Dewpoint temperature and CO_2 percentage of gases from combustion

Air for combustion assumed to be at 60 deg. F. and 100 per cent. humidity with 30in. barometer

Dilute Sulphurous Acid Formed

The theory I advanced was that the flue gases adjacent to the inner chimney wall were cooled below dewpoint; then moisture from the gases was deposited on the inner wall. This moisture picked up sulphur from the flue gases, thus forming a dilute solution of sulphurous acid, when very rapid corrosion ensued.

There appears little doubt that this theory fits the case, for this relatively intense rate of internal corrosion has only arisen since high boiler efficiencies and the necessarily relatively low exit gas temperatures have become the general rule. The normal exit gas temperature of modern boiler plant is round about 220 deg. to 250 deg. F., while when steel chimneys came into fashion the exit gas temperature was 350 deg. F., or even higher.

It would appear that the higher gas temperature enabled the gas to be discharged without the strata in contact with the steel being cooled sufficiently to fall below dewpoint, and therefore, the steel chimneys attached to such plant had a reasonable life and no special precautions were necessary. The advent of high boiler efficiency with the corresponding lowering of the exit gas temperature has evidently brought the latter below what may be termed the critical temperature for deposition of moisture from the flue gases under ordinary atmospheric conditions in this country.

Costs and Tariffs (*Continued from previous page*)

rate of the all-in tariffs. From the selling or competitive point of view the case is much stronger. Mr. Bolton reckons that on purely cost grounds the lighting price per kWh should lie between two and four times the heating price. Flat rates for the two services show an average ratio of about 4½ in the British tariffs examined. In the all-in and block rate tariffs an estimated ratio is about 9½; *i.e.*, while kWh for heating cost about one-half to one-quarter of the lighting kWh, the average price for them is one-fifth to one-ninth that for lighting.

None of the methods of assessing the fixed charges of all-in tariffs is defensible on strictly equitable grounds: that based upon the size of house seems the least open to objection, provided the consumer has the option of a flat rate. Restricted service, time switched two-rate and alternative switching methods are briefly considered as means of directing consumption to off-peak periods. The author's study seems to lead him to an advocacy of "classified flat rates" for both small industrial consumers, and for domestic consumers. These are shown to meet the requirements as well as some of the typical tariffs in use and to be devoid of some of the objections to the latter. I quite agree.

A good technical explanation is given of lagging and leading power factors and how they arise and may be corrected, also an outline explanation to a consumer of the effects of low power factor, the equity of charging for the costs, and the means by which the consumer may avoid having to pay them. Alternative methods of making the power factor an element in tariffs are described. A convenient quantity is suggested as the "extra kVA," the difference between kW and kVA, when any power-factor element in a tariff may be stated as a rate per "extra kVA." The C.E.B.'s charge to a "selected station" comes to one-fifth of the kW demand rate. If the supplier has to correct for low power factor in the distribution system, the relative cost will be increased. Power factor tariffs as they exist, and meters designed to make the measurements required for their application, are discussed and compared.

In a final chapter the author shows that the increase in sales has been largely the automatic result of factory and housing expansions and not of special efforts of the electrical industry; further, the aggregate load factor sticks obstinately at about 34 per cent.

Mr. Bolton suggests that the Electricity Commissioners should be empowered to prescribe suitable forms of tariff for each type of load with maximum values for each type. The Central Electricity Board might even be empowered to give a preferential tariff to undertakings whose systems and tariffs had been approved.

This review is to a large extent a summary of Mr. Bolton's work, but that seems the only way to give a fair impression of the contents. I would commend, and recommend to the attention of all concerned, his freshness of view and also the ingenuity shown in the construction of the numerous graphs illustrating the arguments presented.

Fig. 1 shows the dewpoint temperature of flue gases for five different coals and one fuel oil. Coal No. 1 is an anthracite coal, while the other four coals are bituminous with varying percentages of hydrogen and moisture content. So far as dewpoint temperature is concerned, the curves may be considered as covering the normal range of British steam-raising coals.

It will be seen that with the flue gases entering the chimney at from 220 to 250 deg. F., relatively little cooling is needed to reduce the gas temperature below dewpoint. Incidentally,

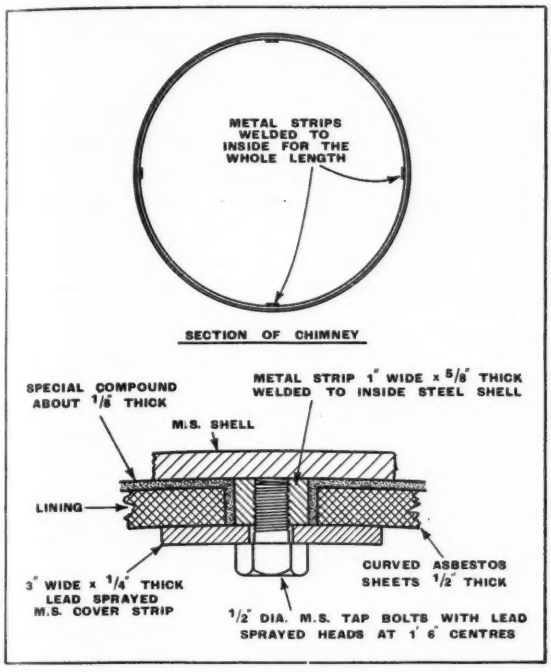

METAL STRIPS WELDED TO INSIDE FOR THE WHOLE LENGTH
SECTION OF CHIMNEY
SPECIAL COMPOUND ABOUT 1/8" THICK
METAL STRIP 1" WIDE x 5/8" THICK WELDED TO INSIDE STEEL SHELL
M.S. SHELL
LINING
CURVED ASBESTOS SHEETS 1/2" THICK
3" WIDE x 1/4" THICK LEAD SPRAYED M.S. COVER STRIP
1/2" DIA. M.S. TAP BOLTS WITH LEAD SPRAYED HEADS AT 1' 6" CENTRES

Fig. 2.—Interior lining of steel chimney to prevent corrosion
Every third horizontal joint is the same as vertical joints, all other horizontal joints have asbestos sheets butting together

the modern trend towards higher chimneys will tend to accentuate the cooling of the gas stream in contact with the inner wall of the chimney, and so again intensify internal corrosion.

Fig. 2 shows the method which I adopted in an attempt to prevent internal corrosion. The new chimneys are of all-welded construction with exterior welded butt straps round the horizontal welds, thus giving a reasonably continuous smooth interior surface with a reasonably true circular contour. Four equidistant vertical steel strips are welded to the interior to take the tapped holes for the fixing screws for the lining. The interior lining is formed by ½ in. thick asbestos cement sheets, made to the correct curvature, which are pressed on to a special mastic composition about ⅛ in. thick and fixed as shown.

Originally, Muntz mental was used for the fixing, but this proved unsatisfactory, and now steel fixings and set bolts are used, and after fixing these are lead sprayed. In effect, a flexible cylinder of heat-insulating material has been fixed inside the chimney, backed by a complete coating of mastic composition which will remain plastic under the temperature to which it is subjected. At about every 15 ft. horizontal supports and fixings are placed, so that should any of the lining come away only a section will be affected.

There were very definite reasons for the adoption of all-welded construction. With riveted construction the interior cannot be a reasonably true circle, nor can the interior surface be smooth. It had been noticed that rivet heads and ledges suffered the most intense corrosion. Many thousands of rivets had the interior heads completely corroded away and had to be renewed. With riveted construction there is bound to be a relatively large space between the interior asbestos-cement lining and the steel shell. The cost of filling this large space with mastic composition would be very heavy, and if it were not filled leakage of gas would probably cause corrosion, perhaps not so severe as without the lining, but still constituting a very real danger.

After careful study of the problem, and a fair amount of experience, I am reasonably certain that the method put forward can only be a real success if all-welded construction is used and a reasonably smooth interior made, so that mastic composition can be used to fill completely the space behind the lining. It is my considered opinion that riveted construction will not produce anything like such satisfactory results as have been achieved by the method used at Hull. The difference in cost between the two methods of construction is negligible, and I believe it to be really essential that riveted construction should not be used with this method of lining.

After eighteen months' service the first of the new type of chimneys was inspected, and on taking out a section of the asbestos-cement lining and cleaning off the mastic composition, the original bloom on the steel plates was still to be seen, without a vestige of corrosion. Since then further experience has been gained as to reliable methods of fixing the interior lining, and it appears quite safe to say that this method of lining does prevent internal corrosion. Experience will reveal reliable methods of fixing. The only real problem is to preserve the lining intact.

The mastic composition was specially prepared by a local firm of paint manufacturers, our requirements being that it should remain plastic indefinitely when subjected to a temperature of 350 deg. F., continuously, and that it should be strongly adhesive. The compound used fulfils these requirements admirably. The structural steelwork, welding in situ, and fixing of the mastic and interior asbestos-cement lining were carried out under contract by a local firm of structural steel engineers. The cost of the method of construction came out at about 70 per cent. above that of a normal steel chimney without any protection.

It should be pointed out that any interior lining of a steel chimney should be really flexible, for very considerable movement of the chimney takes place due to wind and temperature stresses, and any method which does not allow for this is bound to fail. What has been written about chimneys applies equally to outside flues.

There are so many obvious advantages attached to the use of steel chimneys that a rational method of preventing the severe corrosion which has caused them to be superseded should be valuable to power plant engineers. The method described has the advantages of light weight and relatively low cost. The interior lining will obviate interior cleaning, scraping and painting, and will result in the steel shell being kept at a relatively low temperature so that the paint on the outside should last longer. It seems reasonable to suppose that owing to the longer life and decrease in maintenance, although the first cost is higher than that of a plain steel chimney, the actual overall annual cost will be lower. The first cost will be much lower than for a brick or concrete chimney.

There appears good reason to believe that this new method of construction will result in steel chimneys having a life as long as the plant they serve.

Electricity in Metalliferous Mines

The Metalliferous Mines General Regulations, 1938, which were reviewed when in draft form in the ELECTRICAL REVIEW of May 27th, have now been issued as Statutory Rules and Orders No. 630 (Stationery Office, 9d.). These are in the same terms as the draft and are operative as from the beginning of this month for new cables and electrical apparatus. The new Regulations supersede the whole of the General Rules set out in the Metalliferous Mines General Regulations Act, 1872. It will be necessary to establish supplementary short codes in certain classes of mines, but in the meantime existing Special Rules will remain in force in regard to any requirement not included in the General Regulations. Prescribed report books, abstracts and forms will be obtainable shortly from the Stationery Office.

Flameproof Apparatus

Testing Memorandum No. 4 of the Mines Department has been reissued in a revised form (Stationery Office, 3d.). Information included in earlier editions relating to tests and certification of flameproof electrical apparatus has been amplified and brought up to date, in particular by the inclusion of material from M.D. Circulars Nos. 85 and 86 (arrangements for Group 3 tests) and of new requirements for the provision of wiring in conduit.

The Public Lighting Conference

In commenting last week on the forthcoming conference of the Association of Public Lighting Engineers we mentioned that Messrs. J. K. Brydges and N. Boydell were to read a paper on the lighting methods adopted at Bournemouth. These two gentlemen are, of course, at Eastbourne, and it is upon the lighting system of that county borough that their paper is based.

The I.E.E. Library

During the summer (Mondays to Fridays) members of the Institution of Electrical Engineers may use the Institution library between 5.30 p.m. and 8 p.m. if they notify the secretary before mid-day on the day concerned.

Discharge Lamp Control Gear.

By Ir. A. de Bruin*

A comparison of stabilising methods

AN electric discharge lamp cannot function without a stabilising device which, upon a.c. mains, can be conveniently applied as the self induction of a choke in series with the lamp. In this manner the current is stabilised and limited to a given value, instead of increasing indefinitely. This tendency for the current to increase is due to the flat or even negative shape, of the lamp characteristic. In addition to this stabilising function, the choke coil also provides for the considerable drop in voltage which occurs after the lamp has ignited, for the striking voltage of electric discharge lamps is always considerably higher than the operating voltage.

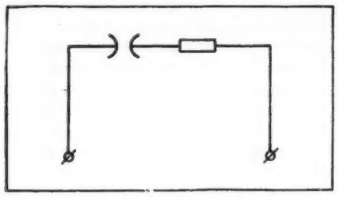


Fig. 1.—Simplified discharge lamp circuit

Supposing a particular form of discharge lamp is made to strike at 230 V, the voltage at the lamp terminals will immediately afterwards drop to a lower value. The choke is designed to ensure that the correct operating current and running voltage are obtained. The following considerations are based upon the simple circuit shown in fig. 1. The lamp, in series with a choke, is fed from mains, the r.m.s. voltage of which is E_n volts. The peak value of this voltage will be represented by E_m, the voltage on the terminals of the lamp under normal working conditions by E_b, the ignition voltage by E_o and the normal current by I.

Theoretically the impedance of fig. 1 could take the form of an ohmic resistance or of a condenser, instead of an inductance. Combinations of these different elements could also be used. Leaving the latter possibility out of consideration, it may be asked which of the three methods is most suitable. Economic considerations immediately eliminate the ohmic resistance because of the great difference between the ignition and operating voltages. This would mean that the major part of the energy absorbed would be dissipated as a pure loss and one of the essential advantages of the discharge lamp, its high efficiency, would be seriously affected. Apart from considerations of efficiency, however, the ohmic resistance is

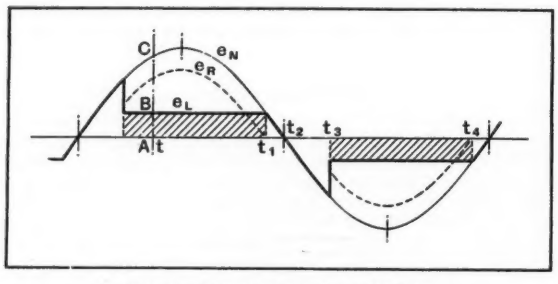


Fig. 2.—Effect of ohmic resistance

unsuitable for technical reasons. The operation of a discharge lamp stabilised by an inductive device, is quieter than that of such a lamp controlled by a resistance or condenser .

It must be remembered that the discharge extinguishes at each half cycle, and restrikes in the following half cycle, at the moment when the voltage again reaches the reignition value E_d. This is not the same as the initial striking voltage E_o, required for the first ignition. The restriking voltage is considerably lower because of the persistence of the ionised state of the metal vapour in which the discharge is produced.

From the instant the discharge ceases, up to the instant of restriking, the current taken and the light produced, fall to nothing. This is the "dark period" and the shorter it can be made, the less frequency flicker and current curve distortion are produced. The duration of this dark period, however, essentially depends upon the method of stabilisation chosen. Only an inductance allows it to be reduced to practically zero.

To appreciate these different phenomena, the variation in lamp terminal voltage in the three cases under consideration, will be briefly examined. It is assumed that the voltage E_b at the terminals of the lamp, has a constant given value, as long as a current flows through the lamp. The ohmic resistance (fig. 2) will first be considered. The instantaneous value of the mains voltage at any moment is represented by AC, the lamp terminal voltage by AB and the voltage on the resistance terminals by BC. At the instant t_1 the mains voltage becomes equal to E_b and the voltage on the resistance terminals is zero. The lamp extinguishes. The lamp terminal voltage now equals the mains voltage up to the moment t_3, when it reaches the value E_d. The lamp restrikes and the voltage drops to the value E_b which it maintains up to the moment t_4. During the half cycle t_1 t_4 the current stops during the interval t_1 t_3 and flows from t_3 to t_4. Under these conditions the dark period extends from t_1 to t_3. Expressed in angular measure, it is :—

$$\text{arc sin}\ \frac{E_b}{E_m} + \text{arc sin}\ \frac{E_d}{E_m}$$

The effect of a condenser will be as follows (fig. 3). At the moment t the mains voltage is AC, the lamp terminal voltage AB and that on the condenser terminals BC. At the moment t_1 the lamp extinguishes and the current ceases. The voltage on the condenser terminals remains constant from this instant, whilst the lamp terminal voltage changes as the mains voltage, up to the moment t_3 when this voltage becomes equal to E_d. The lamp restrikes and the lamp terminal voltage drops again to E_b. The result is that the condenser discharges almost instantaneously from DF to EF ($DF-EF=E_d-E_b$). The lamp

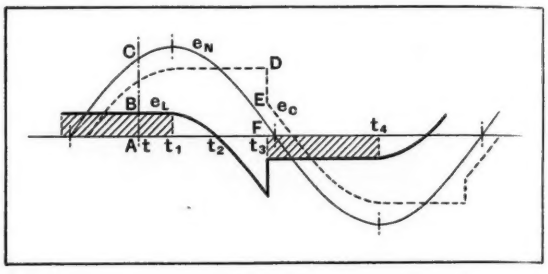


Fig. 3.—Effect of condenser

restriking is thus accompanied by a peak in the current curve, after which the current varies in a nearly sinusoidal manner until extinction at the moment t_4. The half cycle extends from t_1 to t_4, the dark period from t_1 to t_3. The value of the latter is therefore

$$90 \text{ deg.} - \text{arc sin}\ \frac{E_c - E_d}{E_m}$$

where E_c represents the maximum voltage on the condenser terminals. The condenser method also gives rather long dark periods therefore, whilst the current curve suffers considerable distortion.

Finally there is the use of a choke in series with the lamp, to be considered (fig. 4). At the moment t the mains voltage has a value AC, the lamp terminal voltage AB and that on the choke terminals AD. If the lamp extinguishes at the moment t_1 the current ceases for a very brief interval. The self induced voltage also ceases and as there is always $e_n=e_l+e_s$ the result is a rapid increase in the lamp terminal voltage. If the maximum voltage EF on the choke terminals exceeds E_b+E_d, the lamp restrikes almost immediately after extinction. The current then flows during practically the whole half cycle t_1 t_2 and the dark period tends to disappear. On the

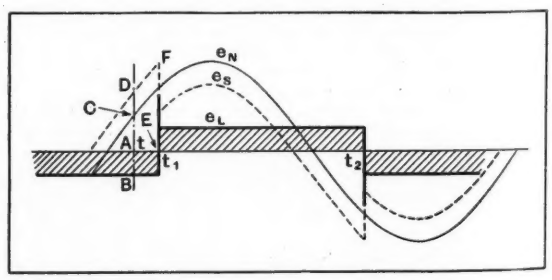


Fig. 4.—Choke in series with lamp

other hand, in spite of the distortion of the induced voltage, the current curve has a very sinusoidal appearance.

The accompanying drawings have been greatly simplified, of course. For instance, an induced voltage does not disappear instantaneously, although the time is very short. Moreover, the restriking voltage E_d is not constant but increases with the dark period, owing to the progressive destruction of the

*N. V. Philips' Gloeilampenfabrieken, Holland.

ionisation state. On the other hand, E_b varies with the current. The method of representation used, however, suffices to illustrate the phenomena under consideration and the figures given agree with reality except as regards these accessory phenomena. (See in this respect figs. 4 and 5. The latter represents an oscillogram of the voltage on the terminals of a choke, stabilising a sodium lamp.)

The low power factor caused by the use of a choke is usually corrected by shunting a condenser of suitable capacity across the lamp and choke. Finally, it should be known that the satisfactory operation of a discharge lamp cannot be assured if the choke does not satisfy certain definite requirements, in design and quality of manufacture. One important factor will be briefly mentioned.

Generally speaking, the light produced by an electric discharge lamp depends largely upon the current passing through the lamp. For this reason it is essential to reduce current fluctuations to the minimum, notwithstanding the voltage variations on the choke terminals. In other words, a working point on the steep part of the magnetisation curve must be selected. The voltage variations on the choke terminals are due to mains voltage variations or possibly ambient temperature changes (the lamp voltage depends upon the temperature) and also upon the life of the lamp. The lamp voltage varies as a function of the life.

Under these conditions it is necessary to avoid heavy saturations of the iron, as they have a tendency to increase the sensitivity of the lamps to mains voltage variations and to changes in the surrounding temperature, as well as to increase the fall in light output during the lamp life.

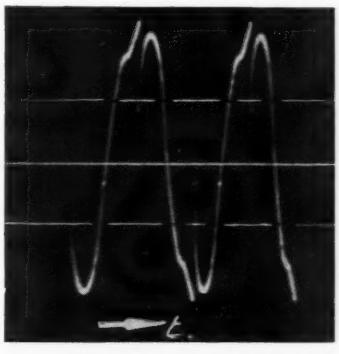


Fig. 5. — Oscillogram of voltage on a choke-stabilised lamp

Electricity in Eire

Board's sales rise by 12 per cent.

INTERRUPTION of building activities due to the prolonged strike during the past year is held chiefly responsible for a lower rate of increase in domestic electricity supplies in Dublin and Cork, but in the remainder of the country the growing distribution system of the Electricity Supply Board resulted in accelerated development. In its annual report the Board states that the Shannon network was extended to forty-seven new areas, bringing the total served to 303.

Altogether, the Board sold approximately 244.5 million kWh during the past year, an increase of about 12 per cent., consumers numbering 145,230, against 130,483 at March, 1937. Domestic consumption showed the greatest improvement, rising by nearly 21 per cent. to 71.9 million kWh—excluding Dublin the expansion was at the rate of 27 per cent.

Energy sold for industrial motive power purposes advanced by 11 per cent. to 80.5 million kWh. The consumption of electricity for general lighting purposes rose by 7 per cent. to 28.4 million kWh and for heating, cooking and water heating in public institutions, hotels, restaurants, schools, etc., by 11 per cent. to 23.9 million kWh.

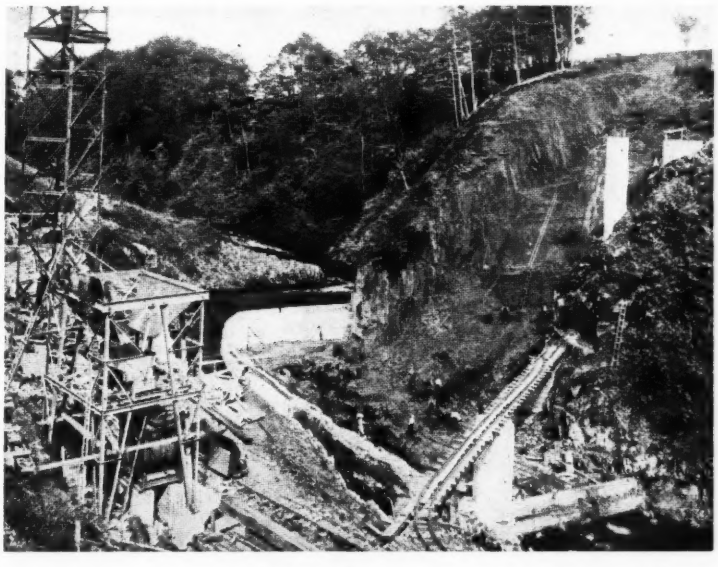
A special effort was made during the year to interest the hotel and restaurant trade in electricity for cooking, and the Board anticipates rapid progress as hotel proprietors become more conversant with the many advantages which the extended use of electricity can bring in the way of better catering. An interesting development was the introduction of electricity as the sole source of heat in a number of large-scale laundries, replacing steam in all laundry processes. Legislation dealing with city milk supplies brought forth a demand for sterilisation plant, and this new requirement was largely met by electrical equipment which possesses the advantages of cleanliness, economy and ease of operation.

The consumption of electricity for public lighting showed an increase of nearly 14 per cent. in Dublin and 7 per cent. in the country as a whole. A stage has now been reached, it is stated, where public appreciation of the value of good street lighting as a most desirable amenity has been definitely secured.

Sales of appliances at £68,274 were up by over £14,000 and the installation contracts carried out totalled £73,102, an increase of over £8,000.

The total energy generated by the Board amounted to 313.4 million kWh and of this 239.2 million kWh was supplied by the Shannon power station, 73.5 million kWh by the Pigeon House station and 0.7 million kWh by the Cork station.

The Liffey Scheme is now well under way, and the contracts placed during the year included the main constructional works consisting of the dam, tunnel and power station at Poulaphouca, and the dam and power station at Golden Falls, the construction of three bridges at Burgage, Blessington, and Humphreystown, respectively, in substitution for bridges which it will be necessary to demolish. At the end of the period under review notices had been served in connection with the acquisition of the land which will be flooded, or required for constructional purposes and negotiations to determine the amount of compensation were in progress.



Preparatory work on the site of the Liffey dam

The presentation of the Board's accounts has been modified by the inclusion in the revenue account of an amount in respect of depreciation accrued during the year as part of the working expenditure. The total revenue is given as £1,736,800 against £1,590,455 in the previous year and the working expenditure as £954,064 (including £215,000 depreciation) against £646,245. Interest and discharge of capital liabilities acquired with local authority undertakings amount to £586,784 (£566,788) and the net balance is £195,952 (£377,422); excluding depreciation these amounts would be £410,952 (£377,422).

Safety in Industry

In a letter to the Press, Mr. Graham Cunningham, managing director of the Triplex Safety Glass Co., Ltd., refers to the suggestion made by Lord McGowan that the Government should undertake a "Safety First" campaign to reduce road accidents. Mr. Cunningham points out that accidents in industry are almost as many. In twelve months 192,725 people were killed or injured on the roads while the corresponding number for industry was 175,470 (excluding mines, quarries, docks, railways, shipping and building which would raise the total to 400,000). Then there are the many accidents in the home and industrial illnesses and diseases. He thinks that carelessness is the underlying cause of many accidents and propaganda could provide a cure for the greater part of the trouble. He suggests that the Government should seriously consider a campaign covering the whole field of accidents.

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Reorganisation of Distribution

If the question you placed at the head of page 147 of your July 29th issue receives a practical response the whole population will benefit.

But many hold the impression that the evidence laid before the McGowan Committee was limited to what that Committee invited. The Report does not give the whole of the evidence. If it could be authoritatively established that all sides of the subject were adequately represented and fully reported less dissatisfaction would exist.

Those consumers whose demands are small added to people not yet consuming constitute more than half our total population, and we know of no evidence that the McGowan Committee gave a thought to their practical interests. The authorised undertakers secured their monopoly areas by consent of the elected local authorities who represent this proportion of the population as much as the portion who are larger consumers.

Future legislation should specifically state the compensating obligation on every distributor imposed when a privilege is conferred. One such privilege is the right to charge for 50 units in a year whether used or not. The compensating obligation should be stated to include placing 50 units at the service of every home willing to pay the minimum charge. The Report of the McGowan Committee does not ensure a square deal for all.

The privilege to require a guarantee up to 20 per cent. of undefined cost over several years was of possible equity in cases (if any) where the local authority imposed statutory conditions on this point; but, where no such conditions were imposed when giving statutory consent, the distributors have had ample time to get their mains to all considerable demands, *i.e.*, Sections 24 and 25 Electric Lighting (Clauses) Act, 1899, have outlived their equity and must be deleted from the Statute Book.

Any reasonable demand within a monopoly area should in future be supplied without guarantee from consumers or, alternatively, in the future Act such part of the area should be taken from the defaulting supplier promptly and given to a satisfactory supplier, even if it involves an area smaller than the Electricity Commission prefers. Costs of connecting a new consumer in too many cases are unreasonably high and unrestricted. It is high time for these costs to be standardised and scheduled.

THEODORE STEVENS.

Herne Bay, *July 29th.*

Domestic Refrigeration

Mr. Rayner's statement in his article published in the ELECTRICAL REVIEW of July 15th "lack of understanding of what refrigeration can do" is undoubtedly the root cause of the tardy development of this business. It is, therefore, primarily a matter of education. It is no exceptional example; domestic electrical development generally has not been dependent upon intensive propaganda for short intervals, exhibitions, and the like, but to steady, persistent, sympathetic contact with prospective users.

Mr. Rayner is right in concluding that the appeal of refrigeration should be broadened to cover the whole year. In our undertaking we recognised this early in the refrigeration development stage and have acted accordingly. Incidentally, we have applied the same principle to electric fires—strange as it may seem, and with success, too! During the first three months of this year we sold thirty-one refrigerators, solely due to the continuance of our sales activities through the year. One feature of these activities is that the salesman during the winter examines and reports upon all refrigerators installed, thus ensuring good service to the purchasers and incidentally obtaining many contacts for prospective sales.

"Critifrig" appears to complain of exaggeration by E.D.A. Whether he can prove this or not I do not know, but I do know that gas refrigeration in this area costs nearly four times as much as electricity, and we do not hesitate to advertise this fact.

Mr. Cathcart mentions the cost of installation as being a retarding influence. This need not be so, as a suitable point can be installed for 15s. and included in the hire-purchase price of the refrigerator. With regard to price, if manufacturers can still further reduce prices without sacrificing quality, and, further, if they will give efficient repair service without always falling back on "this and that" guarantee, so much the better.

PROFRIG.

July 26th.

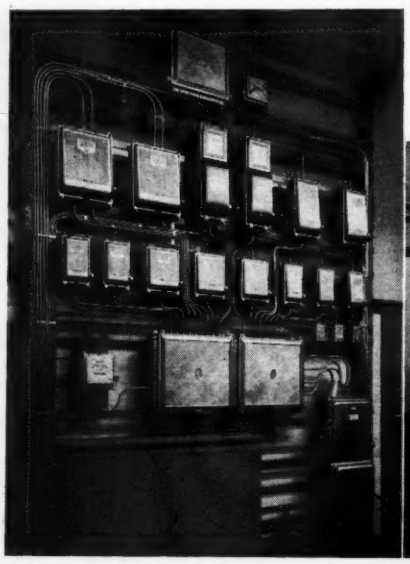
A Trading Estate Canteen

INTENDED to accommodate 540 customers the first of a number of canteens on the Team Valley Estate of the North-Eastern Trading Estates, Ltd., at Gateshead, inaugurated recently, has its kitchen completely electrically equipped. The apparatus comprises a 250-gal. thermostatically controlled water heater and circulator, a double pan fish fryer, and a Hobart potato peeler. In the centre of the kitchen are two double range ovens, two steaming ovens, two vegetable boilers, a stock pot and grill; while in adjoining chambers are a Euk dish washer and a Kelvinator refrigerator. In the canteen itself is a large hot counter complete with a water boiler and a tea and coffee fountain.

The total load is about 180 kW, each of the sixteen circuits being controlled from the main switchboard. The wiring of the circuits and also of the switchboard has all been carried out with Pyrotenax cable. One of the advantages of this cable is that it is much smaller in diameter than conduit, and as all of the runs had to be chased in the concrete floor, it was possible to carry out the work in a much easier way than if conduit had been used. As will be seen from the accompanying photograph, the appearance of the switchboard, too, is particularly neat and workmanlike.

The electricity supply, which is provided by the North-Eastern Electric Supply Co., Ltd., is led through a 300-A switch-fuse feeding a bus-bar chamber. This in turn feeds the various cooking circuits and also the main lighting switch and its distribution system.

The cooking apparatus installed in the canteen was supplied by the General Electric Co., Ltd., and the whole of the installation work was planned and carried out by Robson and Coleman to the instructions of Mr. J. M. Heslop, the consulting engineer.



All the catering equipment employed at the new canteen opened on the Team Valley Trading Estate is electrically operated, the total load being about 180 kW. Below is seen a portion of the kitchen, while on the right is the exceptionally neat main switchboard, the connections being made with Pyrotenax cable

Water Heating Progress

A review of some recent developments

During the past few months water heater manufacturers have been busy on many new designs, most of which were exhibited at the I.M.E.A. Exhibition, although at that time they were mainly in an experimental stage. We are now able to publish more complete details of these developments

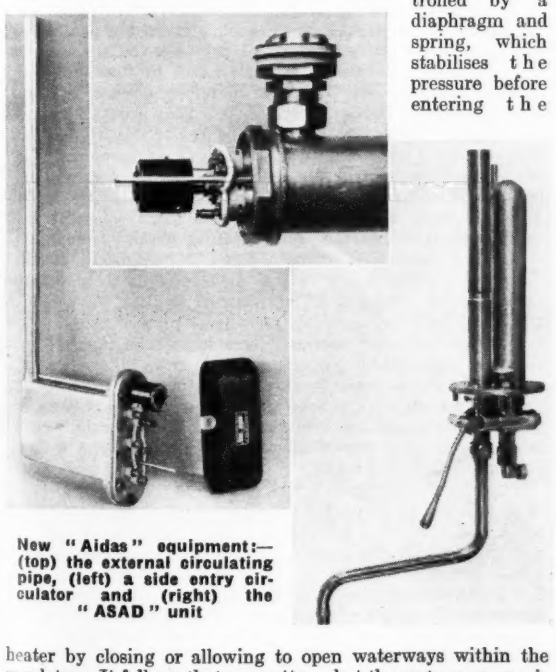
CIRCULATOR design, for vertically fitted heaters, has presented a difficulty where thermostatic control has been incorporated together with a specification combining a very quick service of really hot water with an ultimate full container of water with a reasonably high bottom temperature.

Constructionally the new circulator of SANTON, LTD., Somerton Works, Newport, Mon, differs from standard in that the circulating tube has been shortened leaving a length of element protruding, and the rate of water circulation is definitely controlled at point of entry, but given free egress at the top. The action of the heater switched on from cold is to heat the water rapidly inside the circulating tube, which at the same time takes in at the bottom water which has already been partially heated by the protruding elements. This process provides the desired quick service of really hot water which continues until the balance of temperature between the main body of the water and that in the circulating tube slows up circulation, the convective current set up by the protruding elements ensuring effective bottom temperature.

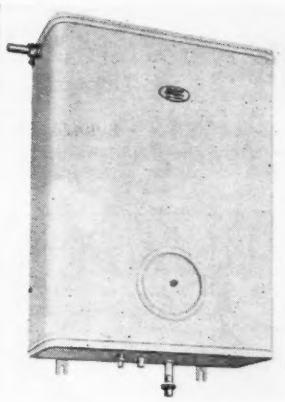
The Drake & Gorham immersion heater for circulator conversion

A high degree of efficiency can be reached by correctly proportioning height and diameter of cylinder, length and loading of heater, and size of inlet controlling circulation, an improved performance being assured by striking a generally suitable average.

The effect of varying water pressure on the uniform performance of electric storage water heaters is very disturbing. Pressures vary in hilly districts as between one position and another, but the pressure at a given position also varies considerably during the day. Particularly is this so in an industrial or partially industrial area. The conventional method of controlling this is by means of a restrictor, which, while ensuring the control of highest pressure, takes no account of the lowest. Santon, Ltd., has produced an automatic water-pressure control valve which is capable of levelling out the flow of high, low, or varying pressure. The water entering the device operates a valve controlled by a diaphragm and spring, which stabilises the pressure before entering the heater by closing or allowing to open waterways within the regulator. It follows that no matter what the water pressure is or how it varies, the regulator automatically reduces it to a pressure suited to standard household apparatus. Apart from achieving this, the heater, once set to a given performance, can be depended upon always to perform in the same way.



New "Aidas" equipment:—(top) the external circulating pipe, (left) a side entry circulator and (right) the "ASAD" unit



The G.E.C. cistern type water heater

Several new introductions in water heating have been made by AIDAS ELECTRIC, LTD., Sadia Works, Rowdell Road, Northolt, Middlesex, one of these being a side-entry circulator. The flange is of the standard pattern, sheathed type "Bray" elements being fitted. The loading density has been kept low and does not exceed 30 W per inch of length. The sheath is made of sheet copper heavily tinned by total immersion. It is removable for easy cleaning and is provided with a boss tapped 1-in. B.S. fine thread for the fixing of the flow tube. This flow tube can be bent if necessary and is supplied in various lengths. A 15-A "Aidastat" thermostat is supplied.

The apparatus is easily fixed as no soldering is required and a perfect joint can be made by unskilled labour. The oblong aperture allows for the easy entry of the flow tube at acute angles even when the circulator is fitted near the floor. As the total projection inside the tank is only 9¾ in., this circulator has the advantage that it can be fitted in any existing storage tank.

The same company has also introduced an external circulating pipe which is intended for fixing to hot water tanks of the indirectly heated or calorifier pattern. It is provided with "Essex" flanges for fixing the flow and return connections and can be easily fixed to copper or galvanised cylinders without having to make a soldered joint. The elements and thermostat are exactly similar to the standard type of top entry circulator.

Improvements have also been made in the "Sadia" 3-gal. water heater, type "ASAD." Furring is reduced by the employment of two standard elements enclosed in a copper jacket filled with heat-conducting material, giving indirect heating. The thermostat plunger tube is in metallic contact with the surface of the heating chamber, and thus eliminates danger of burn-out. An ingenious anti-drip device is incorporated in the improved heater.

A Heatrae type "J.E.19" heater

Two new water heaters have also been designed by HEATRAE, LTD., Norwich. The "DOT" is a new 1½-gallon automatically controlled water heater. As the fixing centres are not in accordance with recognised standards for a 1½-gal. heater, the makers have arranged for top and bottom fixing, which enables it to be put close to a return wall with ease. It is "D" shaped and lies flat against the wall. The loading is the usual 750 W, and all the working parts are interchangeable with the orthodox shape.

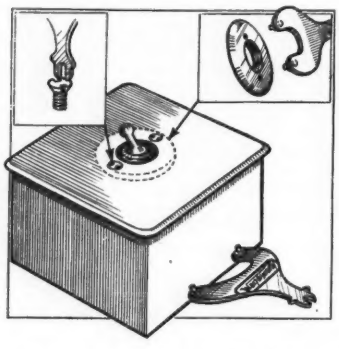
Another newcomer is the "Heatrae" "JEM" type. This is another unorthodox heater, rectangular in form, and made to lie flat on the wall. Both 8- and 12-gal. sizes are available, the loading being 4 kW. It is essentially intended for hand switch control, and incorporates a built-in switch of a special pattern with a clearly marked semaphore indicator.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Locked Flush Switches

From the WANDSWORTH ELECTRICAL MFG. CO., LTD., Imperial Works, Kenyon Street, Birmingham, 18, we have received a sample of a new switch with a locked cover for flush fittings. This is of the 5-A q.m. and b. earthed type and is secured to a ⅛-in. hand-made, substantial, well-finished plate with bevelled edge and rounded corners.



The "Wandsworth" flush switch showing the locking arrangements

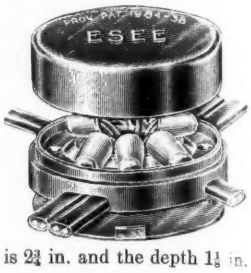
The switch, with back connection terminals, has special pillars and is secured to the plate by secret screws which are covered by a large flanged ring. This ring cannot be removed except with the aid of a special key which fits into the two small indentations in the surface of the ring. The inner screws, too, have a special head, the slots only extending a little way from the edge so that the special key is also necessary to remove them. The key itself is two-headed and can be used for the removal of both the screws and the ring.

The units are available in polished brass, bronze, oxidised silver and chromium in single, double, triple and quadruple section, larger groups being available to order. The unit can also be supplied with a silent action link switch, with special finishes and in a 15-A size, and is specially suitable for use in hospitals, schools and public buildings where the fittings must not be tampered with.

These units are fitted into type "L" adjustable grid boxes with plate fixing centres of 2¾ in. They comprise a box within a box, the adjustable grid being a separate box inside an outer one. Angle adjustment can also be provided. The front plate and box grid form the complete unit and by the removal of two screws the inner box and switches can be taken out. When required the front plate can be attached to the inner box which has a machined face and a cast iron lid.

A Lead-covered Junction Box

The "Esee" lead-covered junction box is a new product of ELECTRICAL CONDUITS, LTD., Birch Street, Walsall. It is die cast throughout and takes any size of cable, two screws only being necessary for fixing the box and bonding the cables, unless wood screws are used, when the cable must be separately bonded. All jointing with connectors can be made before fixing the box and they can then be slipped through the hole in the centre. The diameter is 2¾ in. and the depth 1⅛ in.



The "Esee" junction box

Insulated Service Fuses

A new range of moulded-bakelite single-pole "Iscos" (Serles 3) has been introduced by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1. This range includes a box for a 15-A rewirable fuse and another for the new Henley 30- and 60-A high-rupturing capacity cartridges with replacable elements and single- or multi-way neutral connector box. Tests carried out at the National Physical Laboratory show that these fuses more than comply with the requirements of B.S.S. No. 88-1937 and that they are also capable of clearing 16,500 A without damage.

The 15-A box is designed for either front or back entry; by the use of back connections it is claimed that electricity cannot be obtained by fraud. The larger sizes are suitable for looped services and additional fuse ways can be added; two or more units may be connected by a bus-bar without removing the existing fuses. All models have the fuse carrier combined with the cover and incorporate no loose parts.

Simmering Arrangement

Simmering is now possible on all the "Pyramid" electric saucepans, porringers, coffee urns, &c., supplied by HAGUE & MCKENZIE, LTD., Birmingham. It is achieved by utilising a special plug with one pin made in two halves insulated from each other. According to the way this plug is inserted either the whole of the element or only a part is placed in circuit. Among apparatus fitted with this device are a new steamer for making individual puddings and three new coffee urns.

Water Heating Progress (*Continued from preceding page*)

This heater is not intended to take the place of the standard thermal-storage type, being essentially designed for positions where the tenant will not leave the heater on under the control of the thermostat, but prefers to switch on and off as and when required. The heater also embodies a thermostat. The heater is lightly lagged.

We are informed that one gallon of water at a temperature of 120 deg. can be obtained in five minutes after switching on from cold, or if the switch is left on for ten minutes one gallon of water can be obtained at a temperature of 168 deg. These figures are with an inlet temperature of 60 deg. When baths are required 12 gallons of water at 167 deg. can be obtained in one hour, or with the 8-gal. heater the full quantity can be obtained at an average temperature of 182 deg. in 45 minutes.

The new "Santon" circulator

A complete range of cistern type water heaters has been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. There are five models ranging in capacity from 5 to 30 gal., loadings varying between 1,000 and 3,000 W.

All heaters above 12 gal. capacity are fitted with horizontal electrical equipment introduced from the front, giving improved performance and close control of the water temperature by an adjustable rod type thermostat while the equipment is easily accessible for servicing. The elements are loaded so that any fur deposit forms a hard scale on the heater tube which is cracked off by the expansion and contraction of this tube, during the cycle of operation.

A new arrangement of the cold feed expansion and draw-off connections in these new heaters reduces heat losses, and ensures that the hot water which is retained in the heater to keep the elements immersed is immediately available at a usable temperature as the cold water runs into the tank.

A range of G.E.C. sheathed-wire element type internal circulators has also been introduced. These are arranged so that the element may be removed from the fixing flange and circulating tube (which is left fixed to the tank) for replacement purposes. It is not, therefore, necessary to drain the tank when making replacements. They are also arranged so that the circulating tube can be removed with ease and the circulator converted to a specially long immerser which is quite satisfactory for use in hard water districts and may be fitted through the top of the tank or cylinder. An improved method of construction of the actual element itself ensures accurate location of the heating spiral.

DRAKE & GORHAM WHOLESALE, LTD., 77, Long Acre, London, W.C.2, have also made several developments in the water heating field. There is an anti-furring syphon cap which is the usual dome cap mounted on a lever pivoted at its centre, the movement being obtained by a loose tube inverted over the inlet tube which extends upwards into the heater to a point above the water level. Before water can enter the heater it has to lift the tube which depresses the syphon cap to its working position. On closing the tap the weight of the tube lifts the cap out of the water again. All the working parts are out of the water.

A new unlagged heater of 4 kW loading consists of a copper tank finished in white stove enamel, with 1 in. outlet with spout and ¾ in. inlet with tap. A new immersion heater has two rings which clip on two half round tubes, converting it into a circulator.

A fixing flange with a "V" slot has also been introduced to enable the spigot of the flange to be passed into a totally closed tank, by cutting the net clearance hole only. No special shaped holes or slots are required. The joint is made on the external surface of the tank where it is visible.

New Books

Experimental Electrical Engineering. By E. T. A. RAPSON. (Pp. 181; figs. 202.) London: Sir Isaac Pitman & Sons. Price 3s. 6d.

Practical electrical engineering begins in the laboratory and many valuable experiments can be carried out with comparatively simple apparatus. In this useful book, the author has incorporated more than 100 different experiments covering every part of the syllabus of the examinations for the Ordinary and Higher National certificates and the diploma courses in electrical engineering.

First published in 1932 and since reprinted, the demand for a second edition has yielded the opportunity for bringing the work up to date in the light of modern developments and a number of experiments have been added dealing with a.c. potentiometers, stroboscopic speed measurement, the Schrage motor and the grid-controlled mercury-arc rectifier. An attempt has been made to arrange the experiments in a definite progressive order, in accordance with the increasing skill called for in the technique of laboratory work so that they tend to march in line with the student's increasing knowledge of the theory of his subject. Thus, the earlier groups cover such work as resistance measurement, heating effect of currents and illumination and thence, after a number of experiments on the calibration of instruments, the student is instructed in the handling of d.c. generators and motors for the determination of characteristic curves, efficiencies and so on. From d.c. to a.c. machines is a natural step and after a series of experiments on transformers the work closes with six experiments on rectifiers and valves.

In an inexpensive book of this size explanation of the theoretical principles underlying the experiments are not to be expected; this, of course, the student will obtain from his lectures and the study of theoretical text books. Sufficient is given, however, in the shape of formulæ and graphs, in addition to the actual description of the procedure to be followed and the wiring diagram of the apparatus, to enable him to compile the "course work notes" which are such a feature of present-day engineering examination practice. We can recommend this book to students and teachers in technical colleges as well as to those older engineers who wish to develop or revise their knowledge of research-laboratory and test room technique.—A. R.

Electron Optics in Television. By I. G. MALOFF and D. W. EPSTEIN. Pp. 292; figs. 197. London: McGraw-Hill Publishing Co., Ltd. Price 21s.

Progress in the development of television at present depends more on successful research in optics than on the solving of purely electrical problems. It is true that the particular optical problems of first importance in this respect are those relating to the electron and not therefore wholly separate from electrical science.

Manufacturers of television receivers generally admit that the need for a larger screen is a serious limiting factor in sales. This book is, therefore, published at an opportune moment for, although it details in particular much experience gained in research, mathematical values so far determined and various problems of pure and applied physics, these will most surely lead eventually to simplifying the solution of the practical problem of the larger screen.

The book includes an account of that part of the subject with which the authors have gained first-hand experience at the research laboratories of the R. C. A. Manufacturing Co. of the U.S.A. Much of the material has not previously appeared in book form and much of it is new.

While this book is not an exhaustive treatment of the subject, it is very thorough in the ground it does cover and so imparts a clear understanding of electron optics. Some 230 mathematical formulae are logically set out in a manner which, for the most part, is not difficult to follow. Included in the text is a useful treatment of the cathode-ray tube as used in television, and there is appended an invaluable chapter on accessories.

The book is written for the advanced student and not for the amateur, however experienced in practice. No designer of television receivers using cathode-ray tubes can afford to be without a copy of it, for the discerning reader envisages considerable advancement in design as an outcome.—E. H. T.

Electroinstallation in der Siedelung. Pp. 58; figs. 85. Berlin: V. D. E. Verlag. Price RM.2.

Interest in rural electrification continues to be maintained at a high level in Great Britain, and the appearance of the second edition of the booklet under review indicates that the subject is also an exceptionally live one in Germany.

The purpose of the work is to help the development of electrical applications in rural services. Stress is wisely laid on the need for planning all sections of the electrical installations in an economic way, but without descending to primitiveness. All the applications of electricity which are becoming customary in this country, such as cooking, water heating, soil heating, fodder preparation, milking, and the like, are adequately described. Mention is also made of such less customary applications as controlled lighting of poultry houses and heating of beehives. Power and energy consumptions of all devices are given, together with information as to the usual tariffs.

Adequate guidance is given to ensure that danger to personnel and animals may be avoided. There is an excellent series of drawings of installations and a satisfactory number of illustrations of equipment in service.

The booklet is in all respects interesting and useful and can be recommended with confidence to anyone who wishes to obtain an insight into rural electrification.—C. W. M.

The Science of Seeing. By M. LUCKIESH and F. K. MOSS. Pp. 548; figs. 142. London: Macmillan & Co., Ltd. Price 25s.

The authors of this book have long been known, both in this country and in America, as the originators of a new outlook on the work of the illuminating engineer. They recognise four successive eras in the development of the lighting art, *viz.* (1) mere light, (2) mere foot-candles, (3) production foot-candles and (4) "humanitarian" foot-candles. The last term may not be a happy one; in fact, the authors seem to have a fondness for expressions which shock the sensibilities of the orthodox illuminating engineer, but the fact remains that the conception of light as a "partner" of sight in producing the human activity called "seeing" is one which must be accepted if we are to make the best use of the opportunities offered to us in this age of plenty and comparative cheapness so far as light-production is concerned.

The authors' outlook is well illustrated by the way in which they regard threshold measurements, *viz.*, as "a foundation upon which to erect factors of safety in seeing, just as the conditions of failure of a steel beam are the basis for establishing factors of safety in strength." The book contains an excellent account of the many researches which have been carried out by the authors and other workers in an attempt to map out these vast new areas awaiting cultivation. Unfortunately, the points available for the purpose of "triangulation" are neither as numerous nor as unequivocal in position as could be desired. Nevertheless, the need is there and all who have the progress of illuminating engineering at heart must be profoundly thankful that a start, at least, has been made. The book should be in the hands of every illuminating engineer who is ambitious to join the band of pioneers. He will find it annoying sometimes, informative frequently and stimulating always.—J. W. T. W.

Problems in Radio Engineering. By E. T. A. RAPSON. (Pp. 117.) London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d.

This is the third edition of a useful little book which was first published three years ago. It consists of questions taken from examination papers in radio communication of the City and Guilds, the I.E.E. and London University. The questions are classified in sections under forty-four headings, each list of questions being introduced by a short résumé of the main principles involved. Answers to the numerical questions are given at the end of the book. Some of the introductory notes to the sections have been amplified, and references for further reading have been added to each section for the convenience of home students. Questions from examinations which have taken place since the last edition have also been included.

This book of questions is very well arranged, and should continue to be of great use to students of radio engineering.—C. G. C.

A Complete System of Bookkeeping for Electricity Supply Authorities. By J. HINDMAN. Pp. 135. London: Gee & Co., Ltd. Price 8s. 6d.

This well-written book is likely to appeal to small authorities with stores and offices in close proximity and is practically confined to stores, staff and workmen's time, transport, and consumers' accounting, other accounting fields receiving little notice.

Large and medium-sized authorities will no doubt prefer their fuller systems of stores accounting under suspense accounts covering all stores transactions instead of the author's hybrid system of some stores being charged at once to jobs concerned and others to suspense accounts. These fuller systems on loose-leaf or slip methods (distrusted by the author) permit of daily circulation of records between distant depôts and centralised offices where use can be made of various mechanical office devices. Continuous stocktaking throughout the year is preferable for such undertakings instead of the one annual stocktaking contemplated in the book with its attendant dislocation.

In the important field of consumers' accounting, electrical mechanised bookkeeping, with its efficient economical results as secured by many large, medium, and even some small undertakings, is decidedly preferable to the author's system, which is, in fact, only suitable for small undertakings.

Timely recognition is given by the author to the great merits of continuous daily meter readings and billings, thus avoiding four heavy quarterly peaks of work. The economies in these spheres, and in the connected spheres of consumers' correspondence and oral inquiries and receipt of cash, which arise from "staggering" and dovetailing of all such work, is now beyond argument. This change from the old conventional quarter-yearly basis has been a great boon to large undertakings in recent times of expansion and has generally been quietly accepted by consumers as inherently sound.

A few other criticisms may be passed. For municipal undertakings the author overlooks that no part of salaries such as the managing engineer's salary may be charged to capital account met from loans under Electricity Commissioners' sanctions. An individual meter record is simply not worth while and was abandoned in at least one large undertaking a quarter of a century ago without detriment. The space devoted to engineering records as distinct from accounting records is not likely to interest financial officers outside small undertakings as these records do not usually fall within their ambit. Interlocking and balancing of works or job order costs with the general book-keeping receives no attention.

The system of key headings or codings for analysis of expenditure to save constant repetition of full titles of accounts is rightly stressed by the author as an important part of his system. Such coding is in successful use in many large-scale businesses outside electricity supply.

In general, the author may be complimented on the production of an interesting book worthy of study by electricity financial officers.—W. E. F.

In the Courts

Hailé Selassie's Claim

In the Chancery Division on July 27th Mr. Justice Bennett again had before him the action brought by Hailé Selassie, Emperor of Ethiopia, to recover from Cable & Wireless, Ltd., £10,613 which he alleged was due to him under an agreement for a radio-telegraph service between Addis Ababa (Ethiopia) and Great Britain. The company did not deny that the money was due to whichever was the sovereign power in Ethiopia and which the Italian Government claimed to be.

Mr. Justice Bennett, when the action previously came before him after a lengthy hearing and after communicating with the Foreign Office on the question of the present status of Hailé Selassie, decided that he had no jurisdiction to decide what the rights of Hailé Selassie under the agreement were in the events which had happened, and made an order staying all further proceedings in the action.

From this decision Hailé Selassie appealed to the Court of Appeal which gave judgment in his favour, holding that the judgment of Mr. Justice Bennett could not be supported, there being no rule of law that deprived Hailé Selassie of his right to make his claim here.

In these circumstances the Appeal Judges remitted the action to the Chancery Division for hearing. Mr. Justice Bennett now held that Hailé Selassie was entitled to recover the sum he claimed from the defendant company and gave judgment for him for £10,613, with costs, but with a view to an appeal from his judgment granted a stay of execution for twenty-one days.

Pending Railway Signal Patent Action

The action brought by General Railway Signals, Ltd., against the Westinghouse Brake & Signal Co., Ltd., for the alleged infringement of a patent, which has been pending for several weeks, has been fixed to be heard before Mr. Justice Morton early in the Michaelmas Sittings, which commence on October 12th next.

The matter concerns the automatic control of railway signals and points, and the plaintiff company's complaint in the case is directed to the installation by the defendants of such a system between Wembley and Stanmore.

Pentode Valve Patent Appeal

The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Scott and Clauson, on July 27th reserved judgment in the appeals by Electric & Musical Industries, Ltd., Marconi's Wireless Telegraph Co., Ltd., Standard Telephones & Cables, Ltd., and the Philco Radio & Television Corporation of Great Britain, Ltd., from the order of Mr. Justice Morton in the Chancery Division allowing the Mullard Radio Valve Co., Ltd., to amend Claim 2 of the specification of its letters patent No. 287,958, dated December 24th, 1926, for a particular form of pentode valve.

The invention in question was "for improvements in or relating to circuit arrangements and discharge tubes for amplifying electric oscillations by means of thermionic devices."

The proceedings before Mr. Justice Morton were reported in the ELECTRICAL REVIEW of February 4th, February 25th and March 4th, 1938, and in the Court of Appeal, July 15th, 1938.

Hazeltine Corporation v. Lissen, Ltd.

Mr. Justice Simonds in the Chancery Division on July 28th delivered his considered judgment in the action by the Hazeltine Corporation, of Jersey City, U.S.A., against Lissen, Ltd., which came before him on a preliminary issue. The action related to an alleged infringement by the defendants of plaintiffs' patent No. 293,462 for an invention of "amplifier volume control for carrier signalling" by the manufacture and sale of a Lissen radio receiver Model 8,114 constructed in accordance with the invention.

Defendants denied infringement and pleaded that if the apparatus did infringe (which they denied) it was manufactured with the leave and licence of the plaintiffs. Defendants relied upon a licence granted to Pye Radio, Ltd., by the plaintiffs, the manufacturers of the receiver. Defendants also set up that the plaintiffs' patent was invalid if the apparatus was not manufactured by the leave and licence of the plaintiffs.

The issue now raised was whether the apparatus in question was or was not manufactured by the leave and licence of the plaintiffs.

In giving judgment, Mr. Justice Simonds said that it was not alleged that the defendants had any knowledge of the conditions of the licence granted to Pye Radio or that they had acted in breach of faith or dishonestly, and there had been no evidence given that Pye Radio had failed to comply with the proviso as to royalties. It was contended for the defendants that they could not in the circumstances be charged with infringement unless they knew the terms and conditions of the licence, and he (the Judge) thought that that contention was right. He held that the plea in the defence that the apparatus was constructed with the leave and licence of the plaintiffs was a valid defence to the action.

His Lordship gave the plaintiffs leave to appeal from his judgment and said that the defendants could take such action as they might be advised as to moving for judgment in the action.

Parliamentary News (BY OUR SPECIAL REPORTER)

Proposed Training Centre

In the House of Commons recently Mr. Cape asked the Minister of Labour if he had considered letters sent him by the Mid-Cumberland Electricity Company, Ltd., suggesting that a training centre should be established in West Cumberland for the training of youths to be wiremen; was he aware that the company offered its premises and was prepared to give other facilities towards helping such a scheme; and what decision had he come to.

Mr. E. Brown said that he was aware of this proposal and of the facilities offered by the company and had the matter under consideration.

Laying Mains in Roads

Mr. O. Lewis asked the Minister of Transport if he would consider the desirability of setting up a joint committee to examine the present state of the laws relating to the right of suppliers of water, gas, and electricity to lay their mains under public highways and report as to whether, and, if so, in what ways, these laws required amending to meet modern conditions.

Mr. Burgin said he would bear the suggestion in mind in connection with the consultation now taking place with the other Departments concerned.

Increased Charges in Sussex

On July 27th Rear-Admiral Beamish asked the Minister of Transport under what statutory authority an electricity company now operating in Sussex was proposing to increase its charges by 10 per cent., notice of which had recently been given.

Mr. Burgin said that electricity undertakers did not require specific authority to vary their charges provided they did not exceed their authorised maxima.

Premises Without Electricity

Mr. Day asked the Minister of Transport how many authorised undertakers were at present receiving direct supplies from the grid system of the Central Electricity Board and were in turn distributing them; and if he would give particulars of any estimate his department had made of the number of houses and farms in England and Wales that were without electricity.

Mr. Burgin said that 213 separate authorised undertakers were receiving direct supplies from the grid at the end of June, 1938. The returns rendered to the Electricity Commissioners by authorised undertakers showed that in England and Wales approximately 3.7 million domestic premises and approximately 96,000 farms and horticultural premises had not been connected to the public supply system at the end of 1936-37, the latest date for which official statistics were available.

Automatic Control on the Underground

Mr. Bull asked the Minister of Transport what were the objects and principal features of the London Passenger Transport Board's new system of automatic traffic control on the Underground railways.

Mr. Burgin said that there had been no change in principle in the signalling system in use on the Board's railways, which embodied the automatic train stop. Mr. Bull might, however, have in mind the system of control by automatic telephones being installed at Leicester Square Station with the object of facilitating communication generally throughout the system.

Swiss Electrical Trade

Large increase in machinery exports last year

IN the following statement are given the values for 1937 of the principal items of Switzerland's electrical imports and exports, with the leading countries of origin and destination. They are based on the recently issued official foreign trade returns of that country, increases or decreases compared with 1936 being added. The rate for the Swiss franc is 25 to the £ at par and about 21½ to the £ at the current rate.

On the export side there are a few groups which did not show substantial increases on 1936, the rise in the outward shipments of dynamo-electric machines being very marked. Trade in Swiss meters and measuring instruments showed a healthy recovery. Only in a few lines were imports larger during the past year than exports, *viz.*, accumulators, telephone, telegraph and radio apparatus lamps and certain kinds of cable, but in dynamo-electric machines the balance was favourable to Switzerland to the exent of no less than 15,000,000 francs. Switzerland's electrical export markets are undoubtedly growing in number and variety.

EXPORTS

	1937. Swiss Francs (000).	Inc. or dec. on 1936. Swiss Francs (000).
Accumulators		
Total	285	− 65
To France	64	− 36
„ Canada	19	—
„ Italy	8	− 19
„ Germany	30	− 97
„ Finland	37	+ 27
Insulators—		
Total	298	+ 74
To Ireland	8	+ 1
„ United Kingdom	197	+ 25
„ Poland	25	*
Meters and measuring instruments—		
Total	13,353	+ 2,779
To France	2,876	+ 319
„ Belgium	1,461	+ 479
„ Holland	1,490	+ 518
„ United Kingdom	1,472	+ 210
„ Italy	618	+ 84
„ Czechoslovakia	1,024	+ 342
Telephone and telegraph apparatus—		
Total	579	− 88
To Italy	100	+ 9
„ Belgium	111	+ 67
„ Great Britain	112	− 25
„ Iran	45	*
Radio apparatus—		
Total	500	+ 348
To France	33	− 16
„ Germany	21	− 25
„ Holland	224	+ 218
Glass rectifiers, with or without mercury—		
Total	88	+ 21
To Belgium	23	+ 18
„ United Kingdom	26	+ 9
Unspecified electrical apparatus, over 500 kg.—		
Total	2,718	+ 1,328
To Canada	396	+ 347
„ France	421	+ 234
Ditto, 50 kg. to 500 kg.—		
Total	2,254	+ 884
To France	448	+ 190
„ Holland	208	+ 142
„ India	34	+ 12
„ Italy	118	+ 42
„ Argentina	85	− 62
„ Australia	102	− 58
Ditto, 3 kg. to 50 kg.—		
Total	4,045	+ 1,195
To France	706	+ 166
„ India	62	+ 25
„ Italy	402	+ 55
To Holland	325	+ 100
„ Argentina	102	− 9
„ Germany	462	+ 128
„ Peru	116	+ 84
Unspecified electrical apparatus under 3 kg.—		
Total	1,344	+ 469
Dynamo-electric machines—		
Total	16,941	+ 7,915
To France	1,987	+ 811
„ Italy	1,003	+ 436
„ Belgium	868	+ 665
„ Holland	1,364	+ 1,116
„ Canada	1,371	+ 1,121
„ Argentina	575	+ 162
„ Brazil	494	+ 254
„ India	1,025	+ 635
„ Germany	470	+ 5
„ Peru	280	− 255
„ United Kingdom	722	+ 583
Electric locomotives—		
Total	46	+ 8
Insulated wire and unarmoured cable—		
Total	677	+ 384
To Italy	52	− 16
„ France	88	+ 82
„ Belgium	123	+ 92
„ United Kingdom	119	+ 53
Cable, not lead covered—		
Total	194	+ 76
To France	61	—
Electric incandescent lamps—		
Total	431	− 81
To Germany	395	− 69

IMPORTS

	1937. Swiss Francs (000).	Inc. or dec. on 1936. Swiss Francs (000).
Accumulators—		
Total	364	+ 100
From Germany	148	+ 44
„ France	102	+ 23
Insulators—		
Total	175	+ 59
From Germany	56	− 9
„ Denmark	68	+ 37
Meters and measuring instruments—		
Total	1,331	+ 427
From Holland	108	+ 51
„ Great Britain	112	+ 33
„ United States	122	+ 27
„ Germany	774	+ 279
Telephone and telegraph apparatus—		
Total	1,341	− 135
From Germany	573	− 35
„ Belgium	612	− 213
Radio apparatus—		
Total	5,220	+ 574
From Germany	1,610	− 20
Holland	1,664	+ 304
United States	790	+ 160
Glass rectifiers with or without mercury—		
Total	43	− 13
From Belgium	5	− 9
Holland	12	− 3
Unspecified electrical apparatus over 500 kg.—		
Total	37	− 26
From Germany	11	− 20
Ditto 50 kg. to 500 kg.—		
Total	155	+ 36
From Germany	55	+ 16
France	35	+ 2
Ditto 3 kg. to 50 kg.—		
Total	396	+ 65
From Germany	241	+ 19
France	56	+ 19
United States	24	+ 3
Ditto under 3 kg.—		
Total	945	+ 185
From Germany	741	+ 149
France	95	+ 40
Dynamo-electric machines—		
Total	1,914	+ 504
From Germany	790	+ 124
France	263	+ 7
„ Italy	150	+ 104
„ Holland	98	+ 45
„ United Kingdom	115	− 15
„ United States	125	+ 54
Insulated wire and unarmoured cable—		
Total	176	+ 112
From Germany	65	+ 46
„ France	9	+ 8
„ Holland	32	—
„ Italy	36	*
Cable, not lead-covered—		
Total	314	+ 89
From Germany	199	+ 66
Cable, lead-covered—		
Total	348	+ 273
From Germany	301	+ 239
Electric incandescent lamps—		
Total	2,462	+ 336
From Germany	505	− 95
„ Holland	1,119	+ 167
„ Austria	186	− 14
„ Hungary	377	+ 162

* Comparative figures not available.

Argentine Electrical Imports

Twenty per cent. increase in 1937

MORE than a 20 per cent. increase occurred in the value of Argentine imports of electrical goods last year, as compared with 1936. This advance was spread over all the important groups with the exception of the lighter descriptions of insulated wire, the decreases in these cases being due partly to the unusually large quantities imported in 1936 and partly, in all probability, to a certain amount of local manufacture, there having been developments in this direction in recent years.

In the radio group it is noteworthy that imports of complete receiving sets showed a healthy rise while those of parts increased by nearly 50 per cent., the latter no doubt being imported for the large number of radio assembling shops which have been established in Argentina.

The following figures are taken from the recently issued foreign trade returns, notes of increases or decreases compared with 1936 being added. The values are in paper pesos, worth about 17 to the £ according to the valuation adopted by the Argentine Customs. No details regarding the participating countries are yet available.

	1937. Pesos (000).	Inc. or dec. on 1936. Pesos (000).
Dynamos and motors	3,190	+ 378
Fan motors	357	+ 136
Cable and wire, up to 5 mm. covered with cotton, rubber, etc.	1,554	− 119
Cable and wire, over 5 mm., covered with cotton, rubber, etc.	548	+ 112
Cable and wire, up to 5 mm., lead-covered	284	+ 31
Cable and wire, over 5 mm., lead-covered	3,027	+ 1,103
Cable and wire, silk-covered	34	− 11
Cable and wire, enamelled	405	+ 107
Flex, covered with cotton, wool, etc.	584	− 1,483
Flex, covered with silk	42	− 39
Telephone cables, underground, lead-covered and steel or iron armoured	6,950	+ 2,703
Telephone cables, iron or steel, covered with cotton, gutta-percha, etc.	570	+ 163
Accessories for underground cables	165	+ 90
Complete accumulators for motor-cars	156	+ 51
Other accumulators and parts	1,851	+ 643
Batteries	1,798	+ 165
Ammeters and voltmeters	180	+ 56
Radio-telephone apparatus	1,009	+ 166
Receiving sets	4,338	+ 1,088
Loudspeakers, metal	133	+ 59
Radio-telephone parts	3,414	+ 1,148
Telephones	935	+ 337
Telephone material	834	− 7
Telegraph material	45	+ 19
Cookers, toasters, heaters, etc.	211	+ 43
Switches, circuit-breakers, cut-outs, fuses, etc.	1,506	+ 331
Vacuum cleaners	228	+ 14
Electric bells	58	+ 29
Insulating tape	268	+ 22
Change-over switches	797	− 143
Telephone switchboards	31	+ 18
Electric furnaces	99	+ 36
Incandescent lamps	1,923	+ 203
House-service meters	3,222	+ 1,016
Distribution boards	210	− 172
Insulating tubes	1,556	+ 584
Other electrical materials	3,263	+ 454

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Building Exhibition

Electricity will be well represented at the Building Trades Exhibition which is to be held at Olympia, London, from September 16th to October 1st. Once again the British Electrical Development Association is organising an Electrical Section. E.D.A.'s own stand will form the entrance to this and will incorporate two tall pylons surmounted by a facia. The interior will be divided into various sections devoted to the use of electricity in the design and construction of modern buildings, and illustrating the latest types of installation and floor duct systems, planning of electrical kitichens and bathrooms, and efficient and economical schemes of lighting and heating. Large photographs will form the decoration on the exterior walls. Other exhibitors in the Electrical Section will include: Aidas Electric, Ltd.; Belling & Co., Ltd.; Berry's Electric, Ltd.; Beatty Bros.; George Bray & Co., Ltd.; E. K. Cole, Ltd.; Hotpoint Electric Appliance Co., Ltd.; Jackson Electric Stove Co., Ltd.; Premier Electric Heaters, Ltd.; Pressed Steel Co., Ltd.; and Simplex Electric Co., Ltd.

The Factory Lighting Campaign

During the past few years the E.D.A.-E.L.M.A. autumn lighting campaigns have been of a general character, laying down the fundamental principle that better light is a vital contributor to better sight. But, with the coming into force of the Factories Act, 1937, it is clearly advisable, whilst maintaining this principle, to emphasise its timely application to factories and workshops as the Act requires that: "Effective provision shall be made for securing and maintaining sufficient and suitable lighting . . . in every part of a factory in which persons are working or passing."

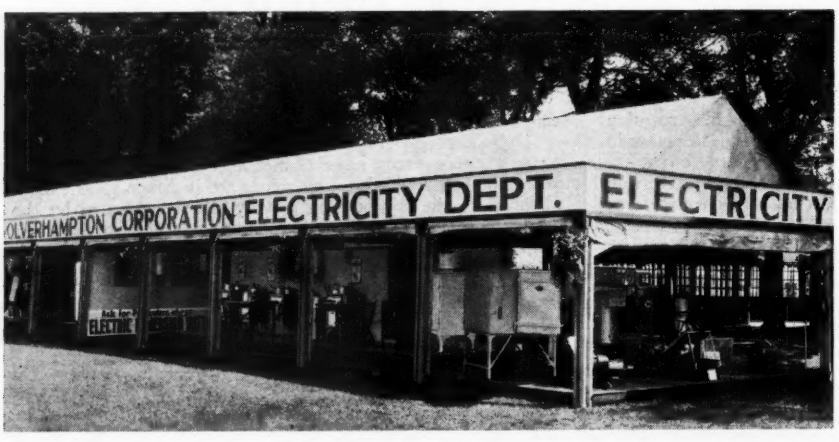
The Campaign will therefore be divided into two parts as follows: (1) General.—National Press advertisements of a general character driving home to the whole nation the message—"Better Light—Better Sight—Better Health." (2) Industrial (factories and workshops). Personal letters to a list of 100,000 factories and workshops.

The direct mail will be supported by propaganda booklets and folders, and by large-scale advertisements and editorial articles in an extensive list of trade journals covering all the important industries of the country. The keynote of the Industrial Campaign will be the provision of the "sufficient and suitable" lighting. Contact with factory owners will be actively sought by the offer of a free lighting survey of their premises and practical advice and assistance in obtaining efficient lighting.

A special appeal is made to supply undertakings and contractors to equip their staffs with lightmeters so as to be able to deal promptly with the inquiries that will be distributed to them. The evidence of a lightmeter is final and irrefutable and—in two minutes—it can do more to convince a customer than the most carefully prepared argument. A demonstration of a lightmeter in a factory is able to result not only in an order for lighting improvements, but also in the sale of the lightmeter itself. Modern lightmeters are entirely self-contained and need no batteries or auxiliaries.

It is felt that with the energetic co-operation of all concerned the campaign cannot fail to extend greatly the demand for electricity and the market for lamps, fittings and installation work.

As some indication of the possibilities it may be said that the 1937 Factory Act imposes lighting regulations on 166,866 factories and 75,153 workshops. The total number of industrial premises coming under the Act is 278,157. The total number of reported industrial accidents in the year 1936 was 176,390. It is authoritatively stated that 33⅓ per cent. of all industrial accidents are caused by bad lighting.



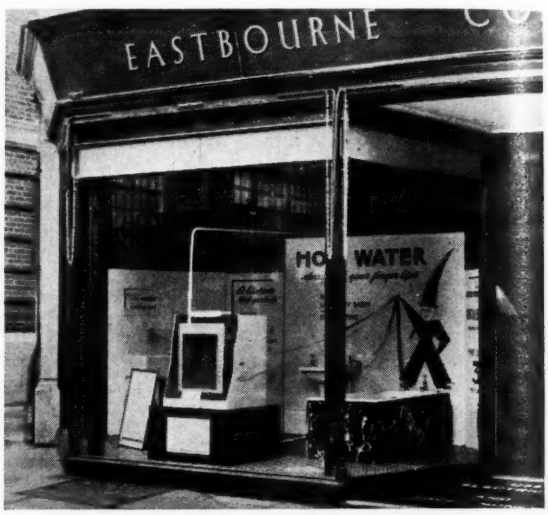
The Wolverhampton Electricity Department's stand at the recent Floral Fête

Accident compensation to the tune of £6,000,000 is paid out every year by employers, but in addition the cost of disorganisation of production, damage to material, loss of skilled labour, &c., has been shown to be more than double the actual compensation payments.

Preliminary details of the lighting campaign for the coming autumn are given in the British Electrical Development Association's sales and publicity programme for August and September. The programme also refers to the autumn number of *Electrical Housekeeping* and describes the 1939 E.D.A. calendar which will feature "Power through the Ages." The second edition of "The Way to a Good Table," the electric cookery book by Elizabeth Craig, is now available.

An Immersion Heater Window Display

The accompanying illustration shows an effective window display arranged by the Eastbourne Corporation Electricity Department. It depicts a complete immersion heater installation in operation In the foreground can be seen a hot water tank which has been converted to electric heating. A plate glass front has been fitted to the tank, through which can be seen the immersion heater and thermostat. The interior is lighted from portholes in the sides of the tank, the lamps being hidden by the lagging. A pump hidden beneath gives a continual flow of hot water to the taps of the bath, lavatory basin and kitchen sink, the steam from which makes the whole display very effective. Mr. J. K. Brydges, M.I.E.E., the borough electrical engineer, informs us that the display has resulted in many inquiries.



An immersion heater display at Eastbourne

Electricity at a Wolverhampton Fête

Considerable interest was attracted at the recent Wolverhampton Floral Fête by a comprehensive display arranged by the Corporation Electricity Department. A special feature of the stand, which was open on three sides, was a complete bathroom with hot water supplied from an immersion heater in a cylinder, this being the Department's standard water-heater hiring scheme. Cooking demonstrations were given in an all-electric kitchen, and there were representative displays of agricultural and dairy farm equipment and also refrigerators, washing machines and other domestic appliances.

Trade with Sweden

The Svenska Handelsagenters Förening (Federation of Swedish Commission Agents), Västmannagatan 4, Stockholm, has drawn our attention to the facilities it offers for securing the services of agents, who are Swedish subjects, to handle export business to Sweden.

Banbury Carnival Awards

Switchgear & Equipment, Ltd., entered two tableaux at a recent hospital carnival held in Banbury. The office entry, "Miss Switchgear Elopes," was the first-prize winner and secured the silver challenge cup. The works entry, "The Bung Ho Cads," won the third prize.

All-electric Milk Bars

There are now in this country almost 1,300 milk bars, and new premises are still being opened at the rate of about fifteen a week. Judging from the experience of Central London Electricity, Ltd., which has now ten all-electric bars in its area, a considerable and profitable load is awaiting development in this direction. It is estimated that each bar consumes annually about 200,000 kWh. Forte's Bar, Leicester Square, the latest to be opened in the Central London Co.'s area, has a total installed loading of 81 kW, made up as follows:—Lighting, 10 kW; heating, 15 kW; power, 3 kW; cooking 33 kW; water heating, 18 kW; and refrigeration, 2 kW. While attractive in appearance the general layout makes the maximum use of available space without the impression of undue congestion, the kitchen arrangements in particular being a model of compactness. The latest type of apparatus and fittings installed includes electric cooking equipment of various makes, Heatrae milk urns and a special 100-gal. water heater with elements top and bottom, a B.T.H. refrigerator and a Kelvinator ice-cream freezer. A general lighting intensity of 4 W per sq. ft. is obtained by the use of the latest Curtis semi-indirect fittings. A combined system of convectors and tubular heaters is to be installed ready for the autumn, and adequate ventilation is provided by means of an extract system (installed by James Combe & Son, Ltd.), embracing the kitchen and main bar. The

[Elec. Rev. photo.

Forte's all-electric milk bar, Leicester Square, seen from behind the counter

electrical installation was carried out to the design of the Central London Electricity, Ltd., the wiring being undertaken by Drake & Gorham, Ltd.

Belfast Civic Week

Electricity will play a prominent part during Belfast Civic Week, planned for September 5th to 10th to celebrate the city's Jubilee. Supplies will be available at special low rates for illuminations and the City Hall will be floodlighted. The Harbour power station, controlled by the Corporation, will be open to visitors who will be able to see one of the city's two original generators alongside its modern equipment. Belfast's rapid growth will be reflected in the contrast thus afforded. Mr. F. H. Whysall, the city electrical manager, tells us that the first two generators supplied by Siemens Brothers in 1895 had a capacity of 55 kW each. The latest turbo-alternator installed is rated at 30,000 kW, while in the autumn the station's total capacity will be raised to 120,000 kW. It is also proposed to include the sister "antique" generator in the principal procession, while five of the Department's vehicles, suitably equipped and illuminated, will tour the city's streets. At the Corporation's showrooms an exhibition will be held of domestic apparatus and distribution gear, including cables and wiring, old and new, as well as specimens of original types of the electric lamp. In addition to specially dressed windows the showroom will display photographs indicating Belfast's electrical growth. The head office will also be open to provide the citizens of Belfast with an opportunity of seeing the organisation of the administrative side.

Topical Publicity

Last week the new *Mauretania* was launched, and Wright, Bindley & Gell, Ltd., makers of light metal pressings, &c., took advantage of the occasion to send out a circular in which the old *Mauretania* is stated to have been far ahead of her period when she was built in 1907. The company claims similar attributes and encloses with this letter a small piece of the woodwork of the old vessel as a memento.

"Simplex" Showroom Alterations

Alterations to Creda House, the London premises of Simplex Electric Co., Ltd., have just been completed. The entrance

The remodelled showrooms of the Simplex Electric Co., Ltd., at Creda House, 219, Tottenham Court Road, London, W.1.

from Tottenham Court Road has been modernised and considerably improved, and ample space is provided for the inspection in comfort of "Creda" and "Simplex" appliances, which are displayed in a neat and attractive manner.

A Disclaimer

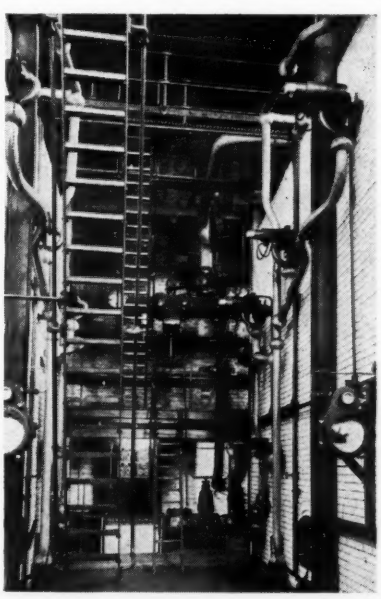
Mr. H. W. Martin, managing director of the Vulcan Electric and Mechanical Co., Ltd., Ponders End, and owner of the Enfield Conduits Co., Ltd., Westminster, asks us to state that he has no connection whatever with Mr. H. W. Martin mentioned in our last issue under the heading "Bankruptcy Proceedings."

Aluminium Production in India

The Aluminium Information Bureau announces that the Aluminium, Ltd., group, the large Canadian producer of aluminium, and the British Aluminium Co., have formed joint plans for the production and rolling of aluminium in India. Companies will be registered in India shortly having a total capital of approximately Rs.12,000,000 (£900,000). *The Times* understands that substantial participation in both capital and management will be offered to Indian interests.

Electric Soot Blowers

It is sometimes necessary for thirty or forty soot blowers to be fitted on large boilers and for the tubes to be cleaned thoroughly the blowers must be operated three or four times a day. The British Thomson-Houston Co., Ltd., has evolved a scheme for the electrical operation of soot-blower heads which releases



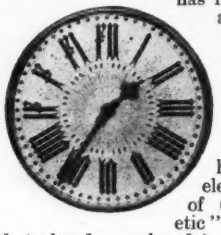
Soot blowers in the power station at the B.T.H. Rugby Works

the staff previously engaged on this duty for other useful work, and also eliminates the possibility of awkwardly placed heads being overlooked. The essential components of the system are an electric motor with speed-reducing gear, controlled automatically. Starwheels and operating studs on each head cause a varying number of operations to be made before coming to rest. The heads are controlled from a cubicle on the floor of the boiler-house (the front of the cubicle being divided into panels corresponding to the number of heads). A push-button on the master panel causes the whole of the heads to be operated in sequence, each head being started immediately the previous one ceases operation. Any individual head may be operated

alone by means of a change-over switch on the master panel and its appropriate push-button. Lamps on each of the head panels give visual indication of the apparatus in motion, and audible warning is given if any motor comes to rest with steam blowing through the jets, a red lamp on each panel indicating which head has stopped. If a head fails, the next one starts up automatically, and thus the sequence is continued. It is often impossible to repair jammed heads until the boiler has been shut down, and therefore a switch is provided on each panel to cut out any such head and prevent its individual operation. It is sometimes possible to wind a jammed head back in the reverse rotation to a position where steam does not blow through it, and therefore hand-gear is provided for swinging the motor out of operation and bringing it into engagement again. Equipment of this type is being supplied through Babcock & Wilcox, Ltd., to Liverpool Corporation for the Clarence Dock power station.

Electric Clocks for Houses of Parliament

The difficulty of synchronising all the five hundred mechanically operated clocks in the Houses of Parliament, London, has for some time past been causing the authorities to consider the substitution of electric models. Now, in spite of a certain amount of prejudice on sentimental grounds, they have decided as a beginning to have electric clocks installed in the House of Commons, the Gent's "Pul-synetic" system adopted being the same as that already employed in the Government buildings at Delhi, Stormont (Northern Ireland) and Ottawa. The old types of dial, which are so in keeping with the surroundings, are being retained.



Dial of a typical electric clock to be installed in the House of Commons

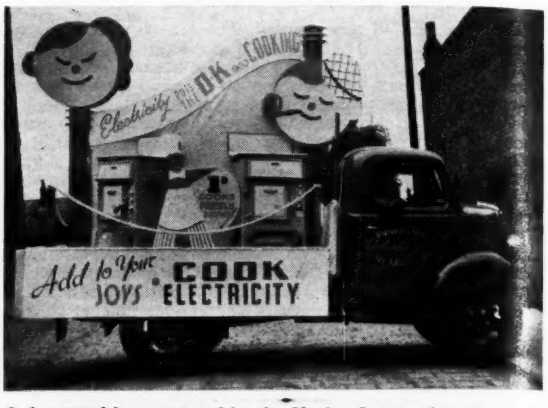
Peterborough Declines German Tender

The Times states that the Peterborough Town Council has rejected, by 14 votes to 8, the tender of the German electrical undertaking Allgemeine Elektricitäts Gesellschaft for the replacement of switchgear and other work at the municipal power station. The German tender of £10,076 was over £4,000 lower than the next British tender.

Trade Announcements

Barlow-Whitney, Ltd., have moved to larger and more up-to-date premises at Coombe Road, Neasden Lane, N.W.10 (telephone: Gladstone 1152-3).

Graham Farish, Ltd., have appointed the following representatives for the sale of their electric fires, fans, floodlights and clocks:—Mr. C. S. Warde (late manager of Dulcetto-Polyphon, Ltd., Manchester Branch), 25, South Drive, Gatley, Ches. ('phone 2422)), to cover Yorkshire, Lancashire, Cheshire and North Derbyshire; Mr. W. A. Small (late of Elexcel, Ltd.), 20, West Campbell Street, Glasgow, C.2 (Central 5400), to cover Scotland; Mr. G. A. Cross, Landreath, Main Woodbridge Road, Rushmere Heath, Ipswich, to cover Norfolk, Huntingdon, Cambridge, Suffolk, Bedfordshire, Hertfordshire, and Essex north of Chelmsford; and Mr. W. A. Archibald, 16, Eldon Square, Newcastle-on-Tyne ('phone, 27669) to cover Northumberland, Durham, Cumberland and Westmorland.



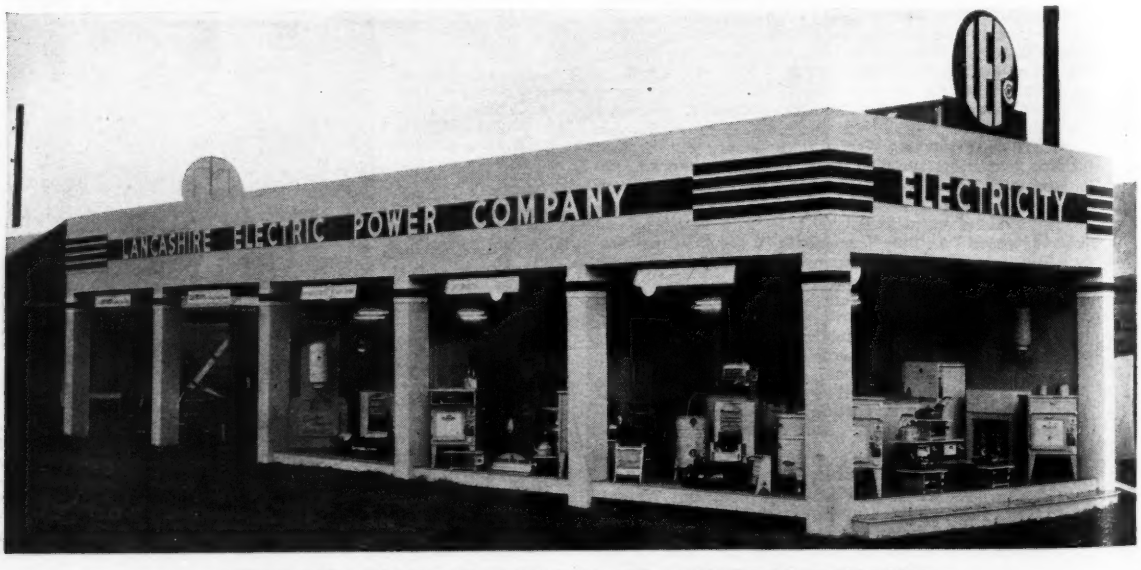
A decorated lorry entered by the Morley Corporation Electricity Department in the recent local annual carnival

Aslib Conference

The Association of Special Libraries and Information Bureaux (ASLIB) will hold its fifteenth annual conference at Lady Margaret Hall, Oxford, during the week-end, September 23rd to 26th, 1938, under the presidency of Sir William Beveridge. It will overlap the end of the fourteenth international conference of the International Federation for Documentation (formerly

The Royal Lancashire Show

THE Lancashire Electric Power Co.'s stand at the Royal Lancashire Show, Liverpool (July 28th to August 1st) included a full range of domestic appliances and a selection of electrical equipment for the farm and market garden. A central feature of the domestic display was an enlarged photograph of the company's power station at Kearsley, to which home appliances were connected by wires and plugs, suggesting the ease with which electricity can be brought into the home and used to increase comfort and save labour. The "Ritemp" electric cooker with automatic oven heat control (English Electric Co.) was demonstrated continually. Santon water heaters, Burco and Alder wash boilers, Epic washing machines, irons and vacuum cleaners, B.T.H. refrigerators, kettles, and fires were some of the other appliances shown. In the farm and horticultural section a new G.E.C. sterilising chest, together with a steaming stool, was demonstrated to farmers, as also was a 5-cwt. "Adelphi" mixer supplied by W. L. Holland, Ltd. Incubators of the Gloucester Incubator Co. were on view, together with "Visi" chick brooders. Various other poultry appliances supplied by Dewhurst's, of Preston, and a poultry-plucking machine supplied by the Bingham Poultry Appliances, Ltd., attracted much attention. Amongst other equipment on the horticultural side was a soil steriliser supplied by the Electro Horticultural Equipment Co. The entire stand was decorated in Prussian blue with drapings to match, relieved with white and black flattings on pilasters and facias. White solid cut-out letters were used for the company's name and for suitable slogans, including one drawing attention to the fact that over 1,000 farmers use electricity from the L.E.P.'s supply.



The stand of the Lancashire Electric Power Co. at the Royal Lancashire Show

the International Institute of Documentation), which is being held in the same building from September 21st to 26th, 1938, under the presidency of Sir William Bragg. Joint sessions will be held at the week-end. Further information can be obtained from the general secretary, Miss E. M. R. Ditmas, 31, Museum Street, London, W.C.1.

Prices of Materials

Henry Gardner & Co., Ltd., report August 3rd : Copper bars (best selected), sheet and rod, £78, £2 inc. English pig lead, £16 10s., 10s., dec. Spelter, £13 16s. 3d., 7s. 6d. dec. English block tin, £194 5s., 5s. dec. Mercury, no change.

Edward Till & Co. report, July 20th : India rubber, Para fine, no change.

New Catalogues and Lists

British Insulated Cables, Ltd., Prescot, Lancs.—Details of the B.I. electric vulcaniser.

Brown Bros., Ltd., Great Eastern Street, London, E.C.2.—Details of "Vitality" electric lamp bulbs for flashlamps and cycles, &c.

Ferranti, Ltd., Hollinwood.—A pamphlet describing an improved clip-on ammeter.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—An illustrated booklet entitled "Electrical Equipment for Rolling Mills."

G. Brady & Co., Ltd., New Islington Works, Ancoats, Manchester, 4.—A booklet dealing with shutters, overhead doors, lifts, and hoists.

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—A 36-page illustrated catalogue of measuring instruments and meters.

Fitter & Poulton, Ltd., Vincent Parade, Balsall Heath, Birmingham, 12.—A leaflet dealing with flexible metallic tubing and adaptors.

Goodliffe Electric Co., Ltd., Goodtric Works, Purley Way, Croydon.—A leaflet illustrating time switches, a floor polisher and an insulation tester.

Bankruptcy Proceedings

J. B. Clements, radio and electrical engineer, 85, Church Street, Tewkesbury.—The first meeting of creditors was held on July 25th at the County Court Offices, Cheltenham, when the statement presented disclosed gross liabilities of £406, of which £396 was expected to rank for dividend. The assets were estimated to realise £149, leaving a deficiency of £247. The debtor attributed his failure to lack of trade and illness. The case being a summary one was left in the hands of the Official Receiver as trustee.

R. D. Farrant, radio dealer, 196, Archway Road, Highgate, and lately carrying on business at rear of 543, Holloway Road, N.—This debtor's application for discharge was heard before Mr. Registrar Kean at the London Bankruptcy Court on July 27th. The Official Receiver reported that debtor failed in February, 1938, with liabilities of £670 and assets which had realised £7. Debtor attributed his failure to disputes with a limited company and to the dismissal of a counterclaim brought by him against the company. The discharge was suspended for nine months.

J. F. B. Wallen ("Auto Radio Co."), radio dealer, 191, Elgin Terrace, Maida Vale.—This debtor attended at the London Bankruptcy Court for his adjourned public examination before Mr. Registrar Parton on July 26th. The Official Receiver reported that debtor failed in February last with liabilities of £1,312 and assets of £10. The examination was concluded.

E. Ramsey, electrical engineer, 8, Springfield Place, and lately 1, Springfield Place, Hunslet Carr, Leeds.—A deficiency of £104 was disclosed at this debtor's public examination held on July 26th at the County Court House, Albion Place, Leeds. The failure was attributed to illness and lack of capital.

H. W. Martin ("Nitram Radio" and "H.M. Radio Stores"), radio dealer, lately carrying on business at 2, The Arcade, High Street, Ponders End, and 15, Station Road, Chingford. —First meeting, August 4th, at 29, Russell Square, W.C.1. Public examination, October 4th, at the Town Hall, Lower Edmonton.

J. Murray ("Murray's Radio and Gramophones"), Bank Buildings, Market Street, Carnforth.—First meeting August 4th at the Official Receiver's Office, 9, Fox Street, Preston. Public examination August 19th at the Sessions Hall, Lancaster Road, Preston.

R. W. L. Frankland, electrical contractor, 45, Russell Street. Middlesbrough.—Trustee, Mr. C. L. Townsend, Official Receiver. 80, High Street, Stockton-on-Tees, released July 14th.

Myrtle Hayes, formerly radio dealer, 40, Barnsley Road, South Elmsall, Yorks.—Trustee, Mr. B. S. Briggs, Official Receiver, 13, Burton Street, Wakefield, released July 14th.

J. J. Scott, electrician, 3, Clifton Street, Lytham.—Receiving order made July 26th on debtor's own petition

F. E. Walton, electrical engineer, Island Hotel, Eel Pie Island, Twickenham, lately residing at "Leacroft," Albourne, Sussex.—First and final dividend of 1s. 4½d. in the £, payable August 9th at 29, Russell Square, W.C.1.

Company Liquidations

Eastonia, Ltd., radio manufacturers, 79, Lichfield Street, Wolverhampton.—The first meeting of creditors was held on July 27th at the Official Receiver's office, 159, Great Charles Street, Birmingham, when the creditors decided that the winding-up of the company should be left in the hands of the Official Receiver as liquidator. No statement of affairs had been lodged.

Warners Electrical Trust, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Rainsbury, Chiswell House, Finsbury Pavement, E.C.2 .

Browning Wireless Manufacturers, Ltd.—Meeting August 30th at 2-5, Dingley Place, City Road, E.C.1, to receive an account of the winding-up by the liquidator, Mr. F. N. Whittaker.

Anti Attrition Metal Co., Ltd.—Meeting August 30th at Glengall Works, Glengall Road, S.E.15, to receive an account of the winding-up by the liquidator, Mr. C. B. Pearce.

Electricity Supply

Lighting, Domestic, Power

Aird (Inverness-shire).—OVERHEAD LINE.—The Council has granted permission to the Grampian Electricity Supply Co. to install an 11,000-V cable between Beauly and Fort Augustus for the purpose of supplying electricity to rural communities on the north side of Loch Ness. The application was sanctioned with a recommendation that the company should install underground cables on arable land and ground with potential building value.

Barking.—NO COMBINED HIRE AND "UNIT" CHARGE.—The borough treasurer and borough electrical engineer recently submitted a report upon the suggestion that there should be an addition to the scale of charges for electricity to provide for the inclusion of the cost of apparatus in the "unit" charge. After careful consideration of the report the committee decided to take no action.

Belgian Congo.—ELECTRIC POWER SUPPLY EXTENSION.—The Société Générale de Forces Hydro-Electriques du Katanga (Sogefor) is to install a fifth 13,200-kW turbo-generator, together with two 6,600/120,000-V transformers, at the Cornet Falls power station. The water storage capacity is also to be increased by raising the height of the dam by about 8 ft.

Chester.—POWER STATION EXTENSIONS.—The Electricity Committee has recommended the Council to apply for sanction to borrow £327,715 for the extension of Queen's Ferry power station.

REVISION OF CHARGES.—Proposed alterations in tariffs include the removal of the ten per cent. added last year to the lighting flat rate, and changes in the tariff for business premises.

Chesterfield.—SUPPLY AT BARLOW.—The Electricity Committee has granted an application by the Derbyshire and Nottinghamshire Electric Power Co., Ltd., for permission to supply electricity to properties in Engine Hollow, Barlow.

Cleethorpes.—ILLUMINATIONS.—This years' illuminations were inaugurated last Saturday and will continue until October 2nd. We are informed by Mr. B. S. Lord, the borough electrical engineer and manager, that the setpieces and tableaux were designed by Miss E. L. Clark, of the electricity showrooms, and carved out in the showrooms in about six weeks. Fluorescent paint has also been used. In addition to the setpieces ten thousand lamps have been installed on the Pier and in the Pier Gardens.

Corby (Northants).—STREET LIGHTING.—Mercury-vapour electric lighting is to be adopted for Occupation Road.

Darlington.—FLAT RATE FOR LIGHTING.—The Electricity Committee has adopted a flat rate of 1¾d. per kWh for lighting all the year round. The existing rate is 3d. a kWh during the four darkest months of the year and ½d. a kWh during the remainder.

Ellesmere Port.—ELECTRICITY FOR LIBRARY.—Tenders are to be invited for the installation of electricity at the Central Library.

Guildford.—ASSISTED WIRING.—The Electricity Committee is seeking sanction to borrow £5,000 for assisted wiring.

Isle of Ely.—SUPPLY TO INSTITUTION.—A sub-committee of the C.C. Mental Deficiency Committee is to report upon the question of an independent supply or a bulk supply from the Beds, Cambs and Hunts Electricity Co. for the proposed mental colony.

Kettering.—SCHOOL HEATING.—Electric heating is to replace the existing system at Hawthorn road Council school. The cost will be £699. Probably electricity will be adopted for heating other schools later.

Leeds.—EXTENSIONS AT KIRKSTALL.—The coal preparation house and plant at the Kirkstall power station is to be extended and equipped at a cost of £86,000.

Leicester.—INCREASING COAL STORAGE.—The Electricity Committee proposes to spend £9,670 on increasing the coal storage capacity at the generating station.

London.—ST. MARYLEBONE.—The Electricity Committee is to provide rising mains at buildings in Seymour Place, Baker Street and St. John's Wood Road at a cost of £542.

SOUTHWARK.—Sanction to borrow £8,000 for meters is to be sought by the Electricity Committee.

The Electricity Committee is to install further wiring in various premises at a cost of £809.

Maidstone.—OVERHEAD EXTENSION APPROVED.—Following notification by the Central Electricity Board that no alternative could be found for the proposed overhead line from Littlebrook to Hastings, the Rural District Council has decided to withdraw its opposition, while repeating its objection from a town planning and amenities point of view.

Malvern.—METERS.—Application is to be made by the Urban District Council to borrow £2,000 for the purchase of electricity meters.

Mansfield.—EXTENSIONS.—The Electricity Committee is to provide a supply to the West End Freeholders estate at a cost of £448.

Manchester.—TARIFF CONCESSIONS.—The Electricity Committee recommends the introduction of a 1d. per kWh charge to users of small power plant, industrial heating and cooking

plant, domestic heating and shop window lighting. The cost of the modifications would be approximately £15,800 a year.

Middlesex.—NEW PLANT.—A new motor generator is to be provided at Acton Technical College at a cost of £305.

Morecambe.—MAINS.—Sanction is being sought to borrow £1,100 for an extra-high-voltage feeder and a pilot cable from the Woodhill Lane sub-station to the Westgate sub-station.

Newcastle-on-Tyne.—ELECTRIC SYRENS.—The Air Raid Precautions Committee has decided to obtain eight electric syrens at an estimated cost of £1,064.

Penistone.—OVERHEAD LINE.—The Urban District Council has granted permission to the Yorkshire Electric Power Co. to erect an overhead line through the town.

Plymouth.—GENERATING STATION EXTENSIONS.—The City Council has approved an extension of the Prince Rock generating station costing £266,980 and increasing the output by 50 per cent. The work will occupy two years, and the Central Electricity Board has requested that the installation shall comprise one turbo-alternator and two boilers.

Prestatyn.—ELECTRICITY CHEAPER.—The lighting flat rate has been reduced from 6d. to 5½d. per kWh, while consumers under the rateable value scale obtain a concession of 2½ per cent. The charge for refrigerator purposes is brought down from 2d. to 1d. per kWh for the summer months and other reductions are also made.

Sunderland.—ELECTRICAL DEVELOPMENTS.—The Electricity Committee is to spend £675,000 during the next five years on electrical developments, including a new generating station which will account for about half the total. Three new sub-stations will account for £15,000

NURSES' HOSTEL WIRING INSTALLATION.—A tender of £1,725 by the Beacon Electrical Co. for the wiring of the nurses' hostel at the Municipal Hospital has been accepted by the Town Council.

Sutton Coldfield.—EXTENSIONS.—Mains and sub-stations are to be extended at a cost of £5,662 and £1,202 respectively.

Ransom.—X-RAY APPARATUS.—The Notts County Council is to provide new X-ray equipment at the sanatorium at a cost of £3,500.

Russia.—HYDRO-ELECTRIC STATIONS FOR COLLECTIVE FARMS.—The construction of a 400-kW hydro-electric station is nearing completion at the village of Constantinov on the river Chamlik in the Khurghan district, learns *Reuter's Trade Service* from Russian papers. The first section of the station, which has a capacity of 200 kW, will supply energy for 1,200 lamps in the houses of the collective workers at Constantinov. With the completion of the second section, electricity will be provided for not only the dwelling houses but also the livestock farms, threshing, irrigation and other undertakings at collective farms. The construction of a hydro-electric station at the Chekist collective farms in the Timashev district has also begun, and next year similar stations will be built at Rodnikov, Kurghan, Labin and other villages.

Sheffield.—NEW EQUIPMENT.—The Electricity Committee is seeking sanction to pay the following sums out of the anticipated surplus:—Meters and current transformers, £15,000; land for sub-stations, £2,000; sub-station buildings, £5,000; transformers for sub-station, £20,000; and sundry apparatus and wiring for apparatus on hire, £20,000. An X-ray unit is to be provided at the hospital by the Health Committee at a cost of £590.

MAINS EXTENSIONS.—Mains are to be extended at a cost of £3,365.

Southend-on-Sea. — ILLUMINATIONS, 1938. — Last Saturday "Never Never Land" was re-opened in an even more attractive form than in the past. Mr. A. C. Johnson, the borough electrical engineer and manager, tells us that the Department has applied fluorescent powders to outdoor features, and this season it is in a position to present a scheme of fluorescent lighting on a larger and more comprehensive scale than anything hitherto attempted in this country.

A section of the "Never Never Land," Southend-on-Sea

Tunbridge Wells.—POPULARITY OF HIRE-PURCHASE.—The Town Council is applying for sanction to a loan of £30,000 for buying apparatus for hire-purchase. Purchases have previously been made out of revenue through the Appropriation Account. It is stated that the number of cookers alone supplied on hire-purchase has risen from 126 in the whole of 1935 to 492 in the first half of the current year.

Warrington. — FRINGE ORDER. — The Electricity Committee is to seek a Fringe Order to supply premises in the parish of Dunham Massey. It is also to erect overhead lines at Croft.

Wolverhampton.—LARGE POWER STATION EXTENSIONS.—The West Midlands Joint Electricity Authority has adopted estimates of capital expenditure amounting to £537,000 for the extension of the Wolverhampton generating station.

Traction

Argentina.—STREAMLINED TRAMCARS FOR BUENOS AIRES.—Following the inauguration of the Transport Corporation of the City of Buenos Aires, streamlined tramcars recently made their first appearance in Argentina, says *Reuter's Trade Service*. The modern tramcar, which is the latest American model, was experimentally placed in service on one of the city's routes, and can develop a speed of 30 m.p.h. The platforms are not separated from the rest of the car by the usual doors, and passengers may enter or leave the car by means of side-doors operated by the driver or conductor. The seats are of the "Pullman" type, upholstered in leather, and twelve lamps provide the illumination. An electric bell-push has been placed by each seat to enable passengers to advise the conductor when they wish to alight. Special suspension is used for the American G.E. motors, and noises caused by friction have been avoided by inserting rubber paddings in the coachwork. The driver is seated, and both the accelerator and the brakes are operated by pedals, although a hand-brake is also provided.

Czechoslovakia.—A BATTERY-OPERATED SHUNTING LOCOMOTIVE.—The State Railway authorities have recently put into operation a special battery-driven electric locomotive for the shunting of passenger and goods trains on sections of the system not so far electrified. The loco., which is designed for a speed of 7½ m.p.h., is equipped with two 57-kW series motors, the power being supplied by a battery of 238 lead cells with a capacity of 630 Ah at a 5-hour discharge rate and a maximum discharge rate of 189 A. Tests in shunting a train weighing 178 tons resulted in the specific power consumption working out at 61.1 Wh per ton-mile.

France.—RAILWAY ELECTRIFICATION.—Some details of the electrification of the railway between Culoz and Modane are given in two recent issues of *La Traction Electrique*. The line, which is about 84 miles long, is operated by d.c. at 1.5 kV. The necessary power is taken at 42 kV from local h.v. distribution systems and is converted at eight sub-stations each comprising three sets of two 1,000-kW, 750-V convertors connected in series. Between Modane and Chambery the third rail system has been adopted, but between Chambery and Culoz overhead conductors are employed.

Glasgow.—UNDERGROUND SERVICE DISORGANISED.—Serious flooding, as a result of a thunderstorm on Thursday of last week, prevented trains from running on the underground system between 7 a.m. and 4 p.m. The water was 2 ft. deep in parts.

Holland.—DIESEL-ELECTRIC TRAINS.—It is reported from Utrecht that twenty five-coach Diesel-electric trains are being constructed in Holland to replace steam locomotives and coaches. The trains are to be delivered in about twelve months.

Hull.—NEW TROLLEY-BUS ROUTES.—Yesterday (Thursday), Major Wilson, of the Ministry of Transport, was to inspect the Beverley Road route, which will shortly be converted to trolley-bus operation. The next route which has been scheduled for conversion from trams to trolley-buses is Holderness Road.

Italy.—ELECTRIC TRAINS.—On a trial journey which has recently been made by an electric train between Rome and Pales was accomplished in 25 minutes, and on the straight sections a speed of 200 km.p.h. is reported to have been attained.

Leicester.—CHANGE-OVER TO BUSES.—The change-over from tram to motor-bus working is to be completed by 1943 and will cost about £350,000.

L.N.E. Railway.—AUTOMATIC TRAIN CONTROL.—The London and North-Eastern Railway Co. announced on Tuesday that the Hudd system of automatic train control is to be installed experimentally on the main line between Edinburgh and Glasgow. The need for the extension of automatic control, which was adopted on the Great Western line some years ago, was emphasised by Lt.-Col. A. H. L. Mount, chief inspect-

ing officer of railways for the Ministry of Transport, in his annual report. The Hudd system has been chosen by the L.N.E.R. in preference to the contact type used by the Great Western partly because the L.M.S. line, upon which there is a considerable exchange mileage, has been experimenting with it, and partly because it considers that recent improvements make the induction system of operation preferable to the contact method. The section to be equipped comprises 47 miles of double track, and in the first instance 250 locomotives will be fitted with it.

Manchester.—TROLLEY-BUSES.—On Sunday trolley-buses replaced trams on the Ashton New Road routes. The through tram service between Droylsden and Old Trafford was discontinued, but a motor-bus service was instituted between Adair Street and Warwick Road. A sub-committee of the Electricity Committee has been appointed to discuss with the Transport Department the prices to be charged for power supplied for trolley-buses.

Newcastle-on-Tyne.—TROLLEY-BUSES INAUGURATED.—Trolley-buses were introduced on the Central Station-Fenham route on Monday, and will replace trams on the Osborne Road-Wallsend route during the month. One-third of the city's tramway services has now been converted to trolley-vehicles and only about twenty-seven miles remains to be changed over. The City Council has taken £90,250 from the general reserve fund of the transport undertaking to cover capital expenditure incurred on trolley-buses during the past year.

Communications

Germany.—HIGH-DEFINITION TELEVISION.—After an experimental period of three months starting from August 5th, a 441-line, interlaced scanning, 50 frames per second public television service will be inaugurated in Berlin. A new transmitter has been installed on the American Haus, in the Adolf Hitler Platz, in the Berlin West End not far from the Broadcasting House and the old radio tower. The range of the new station is stated to be the same as that of the old transmitter which operated on 180 lines from the top of the 400-ft. radio tower. A television licence will be instituted which will no doubt be subject to a fee. In the *Voelkischer Beobachter* the Reich Minister for Posts, Dr. Ohnesorge, states *Reuter* from Berlin, declares that television receiving sets simplified to the greatest possible degree will appear on the market shortly at a very low price.

CHEAP RADIO SETS.—Following the successful methods employed in manufacturing and selling the "people's set" on a joint basis, the German radio authorities have decided to introduce even cheaper sets costing only thirty-five shillings (at par) which will give loud speaker reception of at least the local station and the long-wave national transmitter.

Great Britain.—BROADCASTING HOUSE EXTENSIONS.—A start is to be made shortly on clearing the site of 10-22, Portland Place, London, ready for extending Broadcasting House, and it is hoped that the new building will be completed towards the end of 1940. The extension will be slightly larger than the existing Broadcasting House, and is designed as an office building above the ground floor level with a control suite on the seventh floor and a restaurant on the eight floor. Below ground level the studio accommodation will include a general purposes studio (80 ft. by 54 ft. by 30 ft.), three dramatic studios, an effects studio and a number of rehearsal rooms.

SUBMARINE CABLE.—Preliminary work has now started at Lerwick on the laying of the seven-mile cable for the radio-telephone connection with the mainland *via* Orkney.

Iceland.—HIGH-POWER BROADCASTING.—The Icelandic Government has commissioned the Marconi Co. to increase the power of the existing long-wave station at Reykjavik from 16 kW to 100 kW aerial power. In addition to this station, which was inaugurated on Monday, the Government has also placed an order with the same company for a 1-kW relay station to operate on a medium wavelength. This will be installed at Eidar on the East Coast.

Russia.—WORLD'S LONGEST TELEPHONE LINE.—The longest direct telephone and telegraph line in the world is now being built from Moscow to Khabarovsk, in Siberia, states *Reuter*. The new line will be more than 5,400 miles long, almost 1,250 miles longer than the direct line from Halifax to Vancouver across Canada, at present the longest line in the world. On the new line it will be possible to transmit simultaneously three telephone conversations, nineteen cablegrams, and one telephoto over one pair of wires.

Sweden.—RADIO LICENCES.—The number of broadcasting licences at the end of June was 1,156,781, just over 184 licences per thousand of the population, says *Reuters Trade Service* from Stockholm.

NEW TRANSMITTER ORDERED.—The German Telefunken radio works has received an order from Sweden for the construction of a 100-kW transmitter at Fahlun, the capital of Kopparberg, states *Reuter's Trade Service*. It will be crystal controlled and will possess plate modulation.

Turkey.—NEW BROADCASTING STATIONS.—Two new powerful broadcasting stations are being built by a British company for the Turkish Government. Costing about £350,000, the stations, which are situated at Eti-Messoud, near Ankara, will consist of a medium-wave transmitter and a short-wave installation, and are to be ready to start regular twenty-hours-a-day transmissions from October 29th.—*Reuter* (Ankara).

Progress at Birmingham

THE report for the past year of the Birmingham Electric Supply Committee presented to the City Council last week states that all-round progress was made. Within the undertaking the quantity of electrical energy sold was approximately 778 million kWh. The increase of 70 million kWh, or nearly 10 per cent over the previous year's sales, coming on top of an expansion of 92 million kWh in the previous year, is regarded as very satisfactory. In addition to these sales, 250 million kWh was supplied to the Central Electricity Board for use in other parts of the Central England Area.

Consumers connected at March 31st last numbered 251,864, an addition of 33,499, and the new load connected aggregated 158,814 kW, making the total connections to date 957,766 kW. The assisted wiring and hire-purchase schemes continued to create a steady demand and the schemes for hiring cookers, water-heating apparatus, &c., met with a heavy response.

A survey of the progress made during the past five years shows that the annual sales have made an advance of 343 million kWh, or 79 per cent., that the number of consumers taking supplies has increased by 121,148 or nearly 93 per cent., and the connected load by 476,955 kW or 99 per cent.

Further headway has been made during the year in the important work of changing over from d.c. to a.c. and of increasing the e.h.v. transmission voltage. The cost of these works on the consumers' premises, including new meters and service alterations since a commencement was made six years ago, is £452,660. The whole of the expenditure up to March 31st, 1937, was liquidated as at that date and in the year's accounts now under review the actual expenditure of £14,929 has been charged.

Standardisation of frequency in accordance with the Central England Electricity Scheme has been continuously proceeding, and £2,127,725 has now been expended on this work. Part of the expenditure relates to plant and mains which would eventually be required by the Department, the installation of which was accelerated by the frequency change programme. It was agreed that the cost should be borne by the C.E.B. until such time as the plant would have been required by the Department in its normal course of business. An amount of £230,000 had been paid to the Board up to March 31st, 1938, and a final settlement has now been arrived at in which it has been agreed to pay a further sum of £172,000 in full settlement of the Department's liability in respect of such plant and mains. This means that the Department will have paid £402,000 for assets which originally cost £737,000.

The total revenue for the year was £3,040,518 and the trading expenditure amounted to £2,192,819, including £14,929 in respect of the cost of system and voltage change. The balance carried forward to net revenue account is £847,699 and miscellaneous receipts have increased this to £872,234. After meeting capital charges, income-tax, &c., the surplus on the year's working is £192,538, as compared with £363,207 in the previous year. It should be pointed out that reductions in tariffs which were put into operation from October 1st, 1936, reduced the income for the year by £209,630, while further concessions from October 1st, 1937, resulted in a diminution of income of £32,460.

A balance of £95,474 is brought forward from last year, which added to the surplus of £192,538 and a sum of £62,619 standing to the credit of a reserve account no longer required for the replating of batteries, brings the amount available for disposal to £350,631. It has been deemed advisable to continue, so far as possible, to meet certain items of a capital nature from revenue and the whole surplus has therefore been utilised in this manner. This leaves a balance of expenditure on these items amounting to £12,009 which has been carried forward to next year's account..

Additional loan capital raised during the year, mainly in order to finance extensions at Hams Hall station and distribution requirements, consequent upon expansion of the supply, amounted to £1,331,142, the amount actually expended being £1,342,742 (net). The amount of capital redeemed during the year was £783,307. The total capital raised to date for the purposes of the undertaking is £17,901,288, of which £7,127,787 (equal to 39.82 per cent.) has been redeemed.

At the commencement of the year the balance of the reserve account stood at £730,545. Following procedure in previous years, the fund has been charged with a figure of £1,733 (net) to meet expenditure on voltage change of departmental plant. After crediting dividends and interest and deducting depreciation in the value of securities, the fund is increased from £730,545 to £743,906, now being equivalent to 4.3 per cent. of the aggregate capital expenditure on the undertaking.

The chief engineer and manager of the Department is Mr. F. Forrest.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aldershot.—September 6th. Electricity Department. Two 300-kVA transformers and one four-panel 6,600-V switchboard. (See this issue.)

Argentina.—September 20th. Buenos Ayres Western Railway, Ltd. Rectifier equipments for traction sub-stations. (See this issue.)

Australia.—MELBOURNE.—September 6th. City Council. State Electricity Commission. 22-kV outdoor switchgear and accessories. (T.Y. 24850/38.)*

August 16th. Posts and Telegraph Department. Telephone relay sets. (T. 24830/1938.)*

August 30th. Electrical apparatus, including wattmeters, transformers, voltmeters, &c. (T. 25143/38.)*

VICTORIA.—August 30th. State Electricity Commission. Voltage regulating equipments. (T.Y. 24462/38.)*

Bedlington.—U.D.C. Electric lighting at sixty-four houses at Guide Post. W. Hall, surveyor, Council Offices.

Birmingham.—August 22nd. Electric Supply Department. Railway sidings, including embankments, concrete bridges, river diversion and roads at the Hams Hall "B" power station. (July 22nd.)

October 3rd. Public Health and Maternity and Child Welfare Committee. General electrical engineering and engineering services and boiler plant in connection with extensions at Selly Oak Hospital and Infirmary. (July 29th.)

Devon.—August 27th. County Council. X-ray equipment at the Hawkmoor sanatorium, Bovey Tracey. Clerk to the County Council, The Castle, Exeter.

Dublin.—August 31st. Electricity Supply Board. Annual supply of tools. (See this issue.)

Dundee.—August 10th. Electricity Department. Three-core. h.v. and multi-core, l.v., p.i., lead-covered cables. (July 22nd.)

Edinburgh.—September 22nd. City Council. Branch flues for Portobello power station. (See this issue.)

Fife.—August 23rd. County Council. Electric lighting at Pittenweem Police Station, and electrical work at the Welfare Clinic, Markinch. Schedules (£1 1s. in each case) from Mr. G. Sandilands. County Master of Works, County Offices, Kirkcaldy.

Fort William.—September 7th. Electricity Department. Switchgear, transformers, e.h.v. (transmission) and m.v. (distribution) systems, underground (cable) and aerial construction, e.h.v. and m.v. cable interconnection and earthing arrangements for sub-station, meters and meter-testing equipment, and changing over consumers' existing apparatus. (See this issue.)

Glasgow.—August 9th. Corporation. Electrical installation at King's Park School. Town Clerk.

Haslingden.—August 22nd. Town Council. Electrical work in connection with the erection of a gymnasium, nursery classroom and assembly hall. (July 29th.)

India.—SIMLA.—September 6th. Indian Stores Department. Electricity meters for twelve months. (T. 24802/38.)*

Lanarkshire.—August 15th. Scottish Special Areas Housing Association, Ltd. Electrical work at 272, 222, and ninety-two houses. Secretary, 73a, Shandwick Place, Edinburgh, 2.

Leeds.—August 10th. Aerodrome Committee. Electric lighting, heating, power, cooking and clock installations at the Leeds-Bradford Joint Municipal Airport, Yeadon, Yorkshire. (July 29th.)

London.—ISLINGTON.—September 16th. Borough Council. Three-phase e.h.v. switchgear. (July 29th.

COMMISSIONERS OF H.M. WORKS AND PUBLIC BUILDINGS.—August 24th. Electric bell material. (See this issue.)

Manchester.—August 26th. Electricity Committee. 33-kV, three-phase, outdoor a.c. switchgear. (July 29th.)

Middlesex.—August 31st. County Council. Extensions to X-ray apparatus at the Central Middlesex County Hospital. (July 29th.)

New Zealand.—WELLINGTON.—August 16th. Public Works Department. Eight battery-charging equipments. (T. 24820/1938.)*

January 24th. 110-kV outdoor switchgear and steelwork. (T Y. 250/38.)*

September 6th. One three-phase, 300-kVA transformer. (T. 25017/38.)*

November 1st. Remote control and metering equipment. (T. 24495/38.)* 50-kV outdoor steelwork and switchgear. (T.Y. 24300/1938.)*

November 8th. 10,000-kVA transformer bank for section 458 of the Mangahao scheme. (T. 24496/38.)*

November 15th. Indoor switchgear and control equipment for Waitaki power station. (T. 24497/38.)*

September 8th. Posts and Telegraph Department. 15,840 ft. of telephone cable. (T. 25010/38.)*

Peebleshire.—August 15th. Education Committee. Heating and electrical installation at new central school, Innerleithen Reid & Forbes, 17, Great Stuart Street, Edinburgh.—

Plymouth.—September 3rd. Corporation. Conversion of lifts to a.c. supply. (July 29th.)

Reigate.—August 31st. Borough Council. Street-lighting columns, brackets and lanterns with mercury-vapour discharge lamp control equipment. (July 29th.)

South Africa.—PORT ELIZABETH.—August 25th. City Electrical Engineer's Department. Two 3,000-kVA transformers. (T. 24373/38.)*

August 25th. Five 10,000-kVA reactors, 440-yds. of 6,600-V cable and one h.v., d.c. testing and fault localising equipment. (T. 24785/1938.)*

JOHANNESBURG.—August 17th. City Council. Eleven oil-immersed circuit-breakers. (T.Y. 24691/38.)*

August 24th. One electro dynamometer. (T. 24812/38.)*

PRETORIA.—September 1st. Union Tender and Supplies Board. Telephone apparatus. (T. 24816/38.)*

August 18th. Public Works Department. H.v. switchgear and transformer with l.v. switch. (T.Y. 24951/1938.)*

August 25th. Transformer and h.v. and l.v. switchgear. (T.Y. 24950/38.)*

Stockton-on-Tees.—August 31st. Electricity Department. Meter-testing equipment. (See this issue.)

Sunderland.—August 29th. Electricity Undertaking. P.i. cables, rubber-insulated wire, meters and electric lamps for twelve months. (July 29th.)

Electric cookers, water heaters, wash-boilers and irons for three years. (See this issue.)

Thornton Cleveleys.—August 19th. U.D.C. Six 500-kVA indoor type transformers. (See this issue.)

Tottenham.—August 26th. Borough Council. Electrical stage lighting equipment for the Municipal Hall. (July 29th.)

Uruguay.—MONTEVIDEO.—September 15th. Electricity Supply and Telephones Administration. 290 electric reflectors and lamps. (T.Y. 24680/38.)*

Wembley.—Borough Council. August 26th. Street-lighting equipment. (See this issue.)

Whitby.—U.D.C. Electrical work in connection with a new isolation hospital. Town Clerk, Council Offices, Flowergate.

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Amble.—U.D.C. Accepted. Electric lamp standards (£86).—Met.-Vick. Elecl. Co.

Banff.—C.C. Property and Works Committee. Accepted. Lighting of new primary school at Buckie.—A. Grant.

Denham.—Middlesex Education Committee. Recommended. Electrical installation at senior school (£1,710).—Page & Girling.

Berkshire.—Assistance Committee. Recommended. Electric lighting installation at Wallingford Homes (£76).—H. H. Davis.

Education Committee. Accepted. Electrical installations in schools: Hermitage (£33).—H. Davies; Cookham Rise (£42).—Evans; Wokingham (£148).—Yorktown & Camberley Electric Co.

Boldon.—U.D.C. Accepted. Internal wiring of 124 houses.—A. J. Wares.

Dover.—Town Council. Accepted. L.v. switchgear.—G.E.C.

Guildford.—Fire Brigade Committee. Recommended. Fire alarm syren (£56).—Gent & Co.

Hull.—Telephones Committee. Accepted. Cable (£1,229).—Callender's.

Health Committee. Accepted. Electricity equipment at hospital (£650).—A. Lee.

Leeds.—Health Committee. Accepted. Electrical work at Seacroft Hospital (£138).—North & Jackson. Electrical work at St. James's Hospital (£475).—Santon Electrical Co. One electric lift at Gateforth sanatorium (£189).—F. Porteus & Sons.

Electricity Committee. Accepted. Cables.—Enfield Cable Works (£387); Edison Swan Cables (£316); Crompton Parkinson (£226); Henley's (£190); Metropolitan Electric Cable & Construction Co. (£1,476); Connollys (Blackley), (£1,128); Hackbridge Cable Co. (£1,090); Telegraph Construction and Maintenance Co. (£214) Triple coin prepayment meters.—Measurement. Cleaners.—Hoover; Hotpoint Elecl. Appliance Co.

Libraries Committee. Accepted. Electrical installation at Temple Newsam Mansion (£346).—Lindsay Crawford.

Liverpool.—Electric Power and Lighting Committee. Recommended. Seven mercury-arc rectifiers (£10,500).—B.T.H.

Middlesex.—Health Committee. Accepted. Electrical installation at Western Hospital extension (£674).—Page & Girling.

Notts.—County Health Committee. Accepted. Electrical work at Ransom sanatorium (£960).—F. Meggitt.

Wolverhampton.—Water Committee. Accepted. Two electric bore-hole pumps (£1,973).—James Beresford & Sons.

Orders Recently Booked

C. A. Parsons & Co., Ltd., have received an order valued at £215,000 from the Birmingham City Council for a second 53,500-kW turbo-alternator and condensing plant for the Hams Hall power station. A. Reyrolle & Co., Ltd., have successfully tendered at £92,101 for the supply of main switchgear required.

New Showrooms for Holbeach

The southern district offices and showrooms of the Boston and District Electric Supply Co., Ltd., at Holbeach, have been moved from Church Street to much more commodious premises at Electricity House, 4, Park Road. The telephone number, Holbeach 112, remains unchanged, but in a month or two on the change-over to automatic working it will be Holbeach 2112.

Personal and Social

Information regarding new appointments and other matters of interest for this page are welcomed

Mr. E. V. Baldwin, A.M.Inst.C.E., has been appointed divisional electrical superintendent of the central area of the North-Eastern Electric Supply Co., Ltd. After taking a diploma in electrical engineering at the Leeds University, Mr. Baldwin joined the N.E.S. Co. in 1908, and served with the Tyne Electrical Engineers R.E. during the war, retiring with the rank of captain. Since rejoining the company in 1920 he has held various positions, having been deputy superintendent for eight years.

Mr. P. W. Paget, who has completed forty years' service with Marconi's Wireless Telegraph Co., Ltd., has retired. He was one of the first Englishmen to be associated as technical assistant with the late Marchese Marconi when he came to England in 1896. Joining the Marconi Co. in 1898, he was associated with Marconi in all his early work from that date, including the experiments at the Needles wireless station in the Isle of Wight and at Bournemouth in 1898. In December, 1901, Mr. Paget went to Newfoundland, and with the late Mr. G. S. Kemp assisted Marconi during the experiments which resulted in the reception of the first wireless signals across the Atlantic. He was intimately associated with Marconi's experiments for some years after that date, and when the engineering staff of the Marconi Co. increased in size continued, until quite recently, to carry out valuable work in other departments of the company.

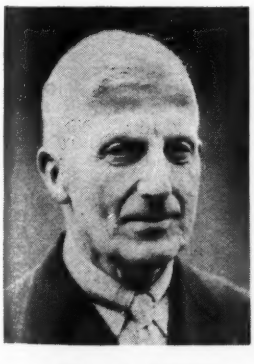
Another of Marconi's original assistants, **Mr. C. E. Rickard,** has just completed forty years' service with the Marconi Co., which he joined in 1898. Mr. Rickard was associated with Marconi in all his early experimental demonstrations in wireless telegraphy, including those given to the G.P.O. and to the British and United States naval and lighthouse authorities. In later years he has been associated with the construction of wireless stations and the development of wireless services in all parts of the world, and has taken part in practically every international conference on wireless matters. For many years Mr. Rickard carried out the duties of chief engineer and technical general manager of Marconi's Wireless Telegraph Co., with which he is still actively associated. He is also a director of the Marconi International Marine Communication Co.

Mr. L. F. Clark, who was formerly with the Sloan Electrical Co., Ltd., as accessories department manager, has now taken up the appointment of sales manager with Castelco (Great Britain), Ltd.

Mr. P. Good, A.M.Inst.C.E., M.I.E.E., A.C.G.I., has had the distinction of Fellow of the Institute (F.C.G.I.) conferred upon him by the Council of the City and Guilds of London Institute.

Mr. A. H. Jackson, consumers' engineer at Clacton-on-Sea, has been appointed to a similar position with the Reigate Corporation. Mr. Jackson has had previous experience at Nuneaton, Worksop and West Hartlepool.

Sir Felix Pole has been appointed a member of the Coal Commission, under the provisions of the First Schedule to the Coal Act, 1938. Other members of the Commission are Sir Ernest A. Gowers, K.C.B., K.B.E. (chairman), Mr. G. Ponsonby Hyslop, M.I.Mech.E. (deputy chairman), and Mr. W. M. Codrington, M.C. The fifth member of the Commission will be Mr. J. Jones, C.B.E., LL.D., J.P., whose appointment will date from December 1st.



Mr. O. F. Francis

Mr. O. F. Francis, burgh electrical engineer at Kirkcaldy, was presented by his staff with a pair of binoculars on his retirement on superannuation last week. He was appointed to the position in December, 1902, on the inauguration of the electricity supply, and prior to this was chief electrical engineer to Aldershot Town Council and assistant electrical engineer to Bootle Corporation.

Following upon the death of the chief engineer and manager, Mr. E. F. Hetherington, M.I.E.E., M.I.Mech.E., the West Midlands Joint Electricity Authority has considered the future organisation and has decided that instead of two principal officials as hitherto there shall in future be one principal officer in control of the whole undertaking, and it has appointed **Mr. H. F. Carpenter,** F.C.I.S., F.S.A.A., to that position. **Mr. J. Morton,** M.I.E.E., M.I.Mech.E., chief assistant engineer, has been appointed chief engineer.

Mr. G. C. Taylor has been recommended for promotion to the position of senior shift engineer, and **Mr. W. H. Brabon** for promotion from switchboard attendant to shift engineer with the Hasting Corporation Electricity Department.

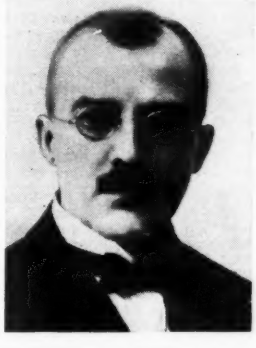
Mr. P. E. Mills has been appointed sub-station charge engineer by the Mansfield Corporation Electricity Committee.

For the third year in succession **Mr. S. A. Hurren,** M.C., M.I.W.T., who is the head of the Department of Radio Technology at the Northern Polytechnic, has been nominated for election as president of the Institute of Wireless Technology.

Mr. T. McCrindle has been appointed secretary of the Belfast Association of Engineers; his address is 11, Waring Street, Belfast.

Obituary

Mr. H. Booth.—We regret to report the death at Eastbourne on July 26th, at the age of seventy-three, of Mr. Harry Booth, O.B.E., who for nearly forty years of his life was closely associated, in an administrative capacity, with all the developments of electricity supply and was one of the original Electricity Commissioners appointed in January, 1920. He took an active part on Lord Cross's Committee of 1898 (Electrical Energy—Generating Stations and Supply) and the Kitson Committee of 1890 on Electric Power Bills, while he was also intimately concerned with the Electric Lighting (Clauses) Act, 1899, the Electric Lighting Act, 1909, and the various Electric Power Acts, including the many Bills for dealing with electricity supply in London. In the course of his career he had to deal with nearly 1,800 Provisional and Special Orders. Mr. Booth was a member of the Electric Power Supply Committee and was associated with Sir John Snell in the preparation and the carrying through of the Electricity Supply Bill of 1919, promoted to give effect to the recommendations of that Committee. He served as an Electricity Commissioner for five years until his retirement in January, 1925, being retained in a consultative capacity by the Commissioners for twelve months after that date.



The late Mr. Harry Booth

Mr. D. Black.—The death occurred recently, at Glasgow, of Mr. Donald Black, electrical engineer, who had been for many years in the service of Colvilles, Ltd., Motherwell.

Mr. A. W. Makovski, whose death was reported in our last issue, was educated at Marlborough and King's College, London. He obtained early experience in cable laying and extensions in South London with the old County of London & Brush Co. In 1896 he established with Mr. Struan Tamplin the business of Tamplin & Makovski, Ltd., at Redhill, and in 1907 the business was transferred to Bell Street, Reigate. A London office was opened in Victoria Street, S.W., in 1897, and one of Mr. Makovski's earliest contracts was the reorganisation and installation in 1898-9 of up-to-date electric stage lighting at the Opera House, Covent Garden, under the direction of Mr. Wingfield Bowles, the consulting engineer. Mr. Makovski was a founder-member of the Electrical Contractors' Association, and was elected a member of the I.E.E. in 1927.

Mr. R. F. Clayton, M.I.M.E., managing director of Tilling-Stevens, Ltd., died last Tuesday.

Wills.—Mr. H. W. Clothier, a director of A. Reyrolle & Co., Ltd., left £45,843, with net personalty (£40,362).

Mr. Thomas Henry Parrott.—We regret that in the notice of Mr. Parrott's will under this heading in our last issue we omitted his surname.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following :—

WESTOLAC enamel.

Electric curry comb.

Laurence, Scott Jubilee

Fifty years ago (on August 11th, 1888), Laurence, Paris and Scott was registered "to carry on the business of an electrical company in all its branches and for such purpose to purchase the business carried on by E. A. Paris and William Harding Scott." The latter concern had been established in Norwich some five years earlier by Mr. W. H. Scott, who is still active in the direction of Laurence, Scott and Electromotors, Ltd. (as the firm is now styled) as chairman.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Metrum, Ltd.—Private company. Registered July 29th. Capital, £5,000. Objects: To acquire the business of manufacturers of mercury arc rectifiers now carried on by the receiver for Conradty Products, Ltd., and to carry on the business of manufacturers of and dealers in cinema and studio carbons, electrodes and anodes, mercury arc rectifiers, &c. The first directors are: J. S. Bacon and Harry Budd. The Société Francaise Metrum and F. H. Pride, Ltd., each have the right to appoint one director. Solicitors: Layton & Co., 38, King William Street, E.C.4.

Scottish Neon Products, Ltd.—Private company. Registered in Edinburgh July 29th. Capital, £1,000. Objects: To manufacture, deal in, hire, install, maintain and repair electrical, neon, gas-discharge and all types of signs, &c. The directors are: D. Miller, 114, Quarry Street, Hamilton; R. B. Wannop, Edena, Uddingston; and J. C. Wither, 17, St. Brides Road, Newlands, Glasgow, C.4.

Radio Services (Blackpool), Ltd.—Private company. Registered July 16th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in radio, transmitting and receiving sets, electrical and television apparatus, &c. The directors are: G. Atkinson, 33, Ashburton Road, Blackpool; and G. D. Hall and D. Hall, both of 10, Pickmere Avenue, Blackpool. Registered office: 34, Topping Street, Blackpool.

Century Automatic Machines, Ltd.—Private company. Registered July 25th. Capital, £5,000. Objects: To carry on the business of manufacturers of automatic, electrical or other mechanical appliances (including appliances incorporating refrigerators) for vending, supplying or distributing ice cream, sweetmeats, &c. The permanent directors are: C. V. Vanbergen (director of V. G. M. Holdings, Ltd.), Lowfield Park, near Crawley, Sussex, and two others. Registered office; 12, Princess Street, Hanover Square, W.1.

Returns of Electrical Companies

United Electrical Co. (Coolex), Ltd.—Satisfaction in full on July 11th, 1938, of debentures authorised July 19th, 1927, and registered July 22nd, 1927. (According to the register of mortgages, the debentures registered July 22nd, 1927, originally secured £1,000.)

Nigerian Electricity Supply Corporation, Ltd.—Satisfaction to the extent of £7,861 on June 30th of trust deed dated August 24th, 1933, and registered August 31st, 1933, securing £300,000 6 per cent. first mortgage redeemable debenture stock.

Partington (Brighton), Ltd.—Particulars filed of £600 debentures, authorised June 11th, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Electronaire Marketing Co., Ltd.—Issue on July 8th of £700 debentures, part of a series already registered.

Britannia Electric Lamp Works, Ltd.—Charge on land and 14, Sunbeam Road, Chase Estate, Park Royal, N.W.10, dated July 18th, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Grimston Electric Tools, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated July 18th, to secure £1,000. Holder: C. E. J. Plutte, Lincoln House, High Holborn, W.C.1.

Maintenance Contracts, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated July 5th, to secure £500 and ranking *pari passu* with an existing debenture. Holders: Branch Nominees, Ltd.

Ray-burn Electrics, Ltd.—W. H. Hawkes, 152, Palmerston Road, Bowes Park, N.22, ceased to act as receiver and manager on July 19th.

Cyril F. Taylor, Ltd.—G. H. W. Ferrett, 14, Aldgate, E.C.3, was appointed receiver on July 5th under powers contained in debenture dated September 18th, 1937.

Electrical Manufacturers Finance Co., Ltd.—Capital, £150,000 in £1 shares. Return dated March 25th (filed May 11). All shares taken up. £150,000 paid. Mortgages and charges nil.

Central London Electricity, Ltd.—Capital, £6,914,760 in £5,306,851 ordinary stock, £1,405,000 4½ per cent. cumulative preference stock and £202,909 6 per cent. cumulative preference stock. Return dated March 22nd. All stock taken up. £1,280,000 paid on £480,000 ordinary and £800,000 4½ per cent. preference stock, £5,634,760 considered as paid on the remainder. Mortgages and charges: £1,628,988.

Summit Electrical Co., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1937 (filed March 4th, 1938). All shares taken up. £100 paid. Mortgages and charges nil.

Flexible Lamps, Ltd.—Capital, £5,000 in £1 shares. Return dated April 20th. 2,800 shares taken up. £2,300 paid, £500 considered as paid. Mortgages and charges nil.

Croydon Cable Works, Ltd.—Capital, £170,000 in £1 shares. Return dated March 23rd. 700 shares taken up. £700 paid. Mortgages and charges nil.

Edison Swan Electric Co., Ltd.—Capital, £432,565 8s. in 300,000 ordinary shares of £1 and 662,827 ordinary shares of 4s. Return dated April 5th. 300,000 ordinary shares of £1 issued and fully paid up. Mortgages and charges nil.

Standard Switchgear, Ltd.—Capital, £10,000 in 1,500 preference and 8,500 ordinary shares of £1. Return dated February 18th. 1,500 preference and 6,100 ordinary shares taken up. £8,600 paid. Mortgages and charges: £6,000.

Nutter, Son & Edge, Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1937 (filed May 4th, 1938). 4,787 shares taken up. £3,987 paid, £800 considered as paid. Mortgages and charges nil.

McMichael Radio, Ltd.—Capital, £250,000 in 150,000 preferred ordinary shares of £1 and 400,000 ordinary shares of 5s. Return dated April 11th, 1938. 143,788 preferred ordinary and 394,304 ordinary shares taken up. £179,864 paid on 143,788 preferred ordinary and 144,304 ordinary shares. £62,500 considered as paid on 250,000 ordinary shares. Mortgages and charges, nil.

S. O. Bowker, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1937 (filed May 9th, 1938). 850 shares taken up. £850 paid. Mortgages and charges, nil.

North Metropolitan Power Station Co., Ltd.—Capital, £100 in £1 shares. Return dated March 29th, 1938 100 shares taken up. £100 paid. Mortgages and charges, £2,485,025.

Excel Electrical Equipment Co., Ltd.—Capital, £3,000 in 3,000 shares of £1 each. Return dated December 31st, 1937 (filed June 3rd, 1938). 600 shares taken up. £600 paid. Mortgages and charges, nil.

Windsor Electrical Installation Co., Ltd.—Capital, £150,000 in 65,000 ordinary, 50,000 5 per cent. preference, 25,000 7 per cent. preference and 10,000 unclassified shares of £1. Return dated March 15th, 1938. 65,000 ordinary, 23,532 5 per cent. preference and 25,000 7 per cent. preference shares taken up. £88,532 paid on 65,000 ordinary and 23,532 5 per cent. preference shares, £25,000 considered as paid on 25,000 7 per cent. preference shares. Mortgages and charges, nil.

Midland Electric Manufacturing Co., Ltd.—Capital, £225,000 in 150,000 ordinary and 75,000 preference shares of £1. Return dated March 29th, 1938. All shares taken up. £85,000 paid on 60,000 ordinary and 25,000 preference shares, £140,000 considered as paid on the remainder. Mortgages and charges, nil.

Magenerator, Ltd.—Capital, £525 in 500 preference shares of £1 and 500 ordinary shares of 1s. Return dated March 18th, 1938. 275 preference and 300 ordinary shares taken up. £290 paid. Mortgages and charges, nil.

F. J. Baynes and Co., Ltd.—Capital, £100 in 100 ordinary shares of £1 each. Return dated August 28th, 1937 (filed April 13th, 1938). All shares taken up. £100 paid. Mortgages and charges, nil.

Russell Wood (Barnet), Ltd.—Capital, £1,000 in £1 shares. Return dated June 9th, 1938. 905 shares taken up. £905 paid. Mortgages and charges, nil.

Tamworth District Electric Supply Co., Ltd.—Capital, £200,000 in 100,000 ordinary, 50,000 6 per cent. cumulative preference and 50,000 4 per cent. cumulative and participating preference shares of £1. Return dated March 10th. 100,000 ordinary, 50,000 6 per cent. cumulative preference and 25,000 4 per cent. cumulative and participating preference shares taken up. £95,000 paid on 40,000 ordinary, 30,000 6 per cent. preference and 25,000 4 per cent. cumulative and participating preference shares, £80,000 considered as paid on 60,000 ordinary and 20,000 6 per cent. preference. Mortgages and charges, £91,413 15s. 6d.

Mather & Platt, Ltd.—Capital, £2,500,000 in £400,000 preference stock, £1,363,660 ordinary stock and 736,340 shares of £1. Return dated March 9th. All preference and ordinary stock taken up. £630,660 paid on £292,000 preference and £338,660 ordinary stock. £1,133,000 considered as paid on the remainder. Mortgages and charges, nil.

Tudor Accumulator Co., Ltd.—Capital, £100,000 in 10,000 shares of £10. Return dated April 7th. All shares taken up. £29,000 paid (£10 on 2,600 and £2 10s. on 1,200 shares, £71,000 considered as paid (£10 on 6,200 and £1 10s. on 1,200 shares. Mortgages and charges, nil.

Seaton and District Electric Light Co., Ltd.—Capital, £50,000 in £1 shares. Return dated April 1st. All shares taken up. £50,000 paid. Mortgages and charges, nil.

Peterborough General Electric Co., Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1937 (filed April 6th, 1938). All shares taken up. £500 paid. Mortgages and charges, nil.

R. Moore & Son (Electricians), Ltd.—Capital, £1,000 in £1 shares. Return dated April 30th. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd.—Capital, £40,000 in 11,500 "A" ordinary, 3,500 "B" ordinary and 25,000 preference shares of £1. Return dated April 22nd. 11,500 "A" ordinary, 2,300 "B" ordinary and 25,000 preference shares taken up. £27,800 paid on 500 "A" ordinary, 2,300 "B" ordinary and 25,000 preference shares. £11,000 considered as paid on 11,000 "A" ordinary shares. Mortgages and charges, nil.

South Metropolitan Electric Light & Power Co., Ltd.—The nominal capital has been increased by the addition of £500,000 beyond the registered capital of £1,100,000. The additional capital is divided into 500,000 third preference shares of £1.

Ernest F. Moy, Ltd.—The nominal capital has been increased by the addition of £15,000 beyond the registered capital of £25,000. The additional capital is divided into 15,000 6 per cent. cumulative preference shares of £1.

T. Clarke & Co., Ltd.—The nominal capital has been increased by the addition of £30,000 beyond the registered capital of £20,000. The additional capital is divided into 25,000 5 per cent. cumulative preference and 5,000 ordinary shares of £1.

Mercury Switch Manufacturing Co., Ltd.—The nominal capital has been increased by the addition of £400 in £1 ordinary shares beyond the registered capital of £1,600.

City Notes

The Nigerian Electric Supply Corporation, Ltd.—Mr. E. Seaborn Marks, chairman and managing director, stated at the ordinary general meeting last week that they had been actively engaged in equipping the Jekko Falls, which lay some five miles below the main station at Kurra, and it was hoped that the new power house would come into service about the end of September. That this development was necessary was amply demonstrated during the last dry season, when they were obliged, for want of water, to reduce the power supply to consumers. In future half the Kurra station would remain in reserve, except possibly in the flood season, and they should be in a position to generate in this particular locality at least 5,300 kW all the year round, in addition to 2,000 kW at the Kwall station. To finance this development and also extensions to the transmission system, they had decided to use the resources they had in hand and to supplement these by loans from their bankers. The company's prosperity depended on the operation of Nigeria's tin mines and visible supplies of tin not being excessive, there were no grounds for pessimism as to the company's future.

The East African Power & Lighting Co., Ltd.—The policy of reducing tariffs as soon as practicable was justified by Capt. H. F. Ward, chairman, at the annual general meeting held in Nairobi last week, when he stated that the diminution of revenue which might have resulted had been more than made up by increased consumption. The total connected load of the Kenya branches had increased from 18,653 kW in 1936 to 20,938 kW in 1937, or by no less than 12¼ per cent. Certain negotiations were proceeding with the Government of Kenya in regard to various matters affecting the company's licences which were of vital importance to the company, but it was hoped that they would be concluded in a manner that would enable them to continue the development of the colony electrically on sound lines. The power station for supplying the Kampala and Entebbe areas was now in commercial service and a large number of consumers had been connected. The construction of the Jinja power station and the distribution system were in hand and a supply would be available shortly. Their subsidiary companies in Tanganyika continued to progress and the heavy construction programme was now completed.

The Jerusalem Electric & Public Service Corporation, Ltd.—Last year the number of consumers rose 19.6 per cent. to 15,825, and electricity sold (6,000,000 kWh) showed an increase of 24 per cent. These figures were mentioned by Sir William Shearer, chairman, at the annual general meeting last week. He added that progress still continued and 560 additional consumers had been connected in May. With the 2,000-kW unit put into commission in the early part of the year, the generating plant now installed should be sufficient to meet requirements for some little time to come, but if the present rate of growth continued additional plant might become necessary at an early date. The bulk of the supplies was for lighting, but the industrial load was steadily increasing. A ring main was being extended to encircle the city completely.

Thorn Electrical Industries, Ltd., had a trading profit of £55,640 for the year ended March 31st, as compared with £49,259 for the preceding year. It is proposed to maintain the dividend on the ordinary capital at 20 per cent. and to place £11,350 (£12,500) to general reserve. Presiding at the annual general meeting last week Mr. Jules Thorn, chairman and managing director, said that the demand for Atlas lamps was steadily increasing and they were again extending their plant. Backed by the advertising campaign planned, together with increased sales organisation, the coming year should be very successful. With regard to the radio side of the business, Mr. Thorn said that a new range of Ferguson receivers with automatic tuning had been produced. Experiments in the cathode ray tube field had been carried out for a considerable time and the gradual development of television was being studied very closely with a view to putting an efficient set on the market on a profitable basis when the time was ripe. The possibilities of the domestic electrical appliance field were being investigated and new "Mary Ann" vacuum cleaners would be marketed shortly. They were looking forward to increased business in the current year.

The Ebonite Container Co., Ltd., made a net profit of £13,423 for the year ended February 28th, compared with £19,192 for 1936-37. General reserve receives £8,000 (£2,000) and £7,894 (£9,271) is carried forward. The subsidiary company, Ferguson, Shiers & Co. (Failsworth) reports a loss of £9,205, but after deducting that amount from the sum standing at the credit of the profit and loss account, £5,011 is carried forward. Contracts in hand should keep the works at Belle Isle profitably employed during 1938.

Barton & Sons (1935), Ltd., have acquired the entire issued capital of the Premier Aluminium Casting Co. and also the freehold buildings, plant, &c., of the diamond grit and shot business hitherto carried on by Harrison Bros. (England), Ltd., at Middlesbrough. Furthermore, 80 per cent. of the issued share capital of Metal Frames, Ltd., is to be purchased. To provide for the development of these associated businesses the capital is to be increased from £500,000 to £650,000.

George Kent, Ltd., report a trading profit of £56,166 for the year ended March 31st last, as compared with £42,917 for the previous year. A final dividend of 7 per cent., making 10 per cent. (same), plus a centenary bonus of 3½ per cent. (nil), are to be paid, and after transferring £5,000 to the dividend equalisation reserve, £5,000 to special reserve, and £1,250 to staff pension fund, a sum of £43,093 (£42,999) is carried forward.

The Britannia Electric Lamp Works, Ltd., records a net profit of £42,494 for its first year of operation which ended on April 30th last. A sum of £12,490 goes to tax reserve and profits amounting to £12,773 earned prior to incorporation (October 29th) have been placed to capital reserve, £9,618 being carried forward. The accounts do not take into consideration any profits earned by subsidiaries.

The Decca Record Co., Ltd., has accepted an offer of £65,000 for the stock, machinery and plant, goodwill and trade marks of the company is so far as radio and television are concerned. This was announced at the annual general meeting of the company last week by Sir Cyril E. Entwistle, chairman, who added that the purchase price was to be satisfied by the allotment of 65,000 shares of £1 each in a new company registered as Decca Radio & Television, Ltd.

The Enfield Cable Works, Ltd., is to pay an interim dividend of 6¼ per cent. This compares with 10 per cent. for last year's interim dividend, but, as the capital was increased last year by a 60 per cent. scrip bonus, the payment now announced is the same as last year.

The Yorkshire Electric Power Co. has announced an interim dividend at the rate of 6 per cent. per annum for the half-year to June 30th on the ordinary stock and the cumulative preference stocks. The interim report states that notwithstanding the falling off of trade in the early part of the year, the company's sales have been increased and contracts have been made for further important power supplies. Increased local rates, wages and other expenses have been met to some extent by a greater efficiency of production. In accordance with the provisions of the coal clause in supply agreements, the price of electric power has been adjusted to meet the largely increased cost of coal. Substantial progress has been made with the construction of the extensions of Ferrybridge power station, and the transmission and distribution systems have been added to.

The Electrical Distribution of Yorkshire, Ltd., in its interim report, states that the number of consumers has been substantially increased. Exceptional weather in the early part of the year lessened the use of electricity for lighting and heating purposes, but the sales for the half-year were greater than in the corresponding period of the previous year. The interim dividend on the ordinary stock is at the rate of 9 per cent. per annum for the half-year to June 30th.

The Kalgoorlie Electric Tramways, Ltd., reports operating receipts for 1937 of £30,461, as compared with £30,055 for 1936, and a net profit, before meeting interest on "B" debenture stock, of £2,951 (£3,502). The net profit has been transferred to credit of sinking fund for redemption of "B" debenture stock.

The Compania Hispano-Americana de Electricidad (Chade) reports gross receipts of M.$N.57,069,000 for the half-year ended June 30th, compared with M.$N.54,087,000 for the corresponding period of 1937.

The Brazilian Traction, Light & Power Co.'s net earnings for the half-year ended June 30th were $9,765,427, against $10,153,498 for the corresponding period of 1937.

The Northampton Electric Light & Power Co., Ltd., is paying an interim ordinary dividend of 4 per cent. (same).

The Rushden and District Electric Supply Co., Ltd., has declared an interim dividend of 4 per cent. (against 3½ per cent.).

The Dublin United Tramways, Ltd., is maintaining its interim dividend at 1 per cent.

John Ismay & Sons, Ltd., report net profits for the year ended March 31st of £40,858, as compared with £42,661 for 1936-37. Taxation reserve receives £3,000, and it is proposed to maintain the dividend on the ordinary shares at 45 per cent. and to carry forward £5,782 (against £7,924 brought in).

Stocks and Shares

TUESDAY EVENING.

AUGUST bank holiday is taken, as a matter of course, to mark the division between the normal desire to deal in Stock Exchange securities, and the seasonal resignation that submits to market inactivity during the latter part of the dog days, *et seq.* The ordinary daily population of the Stock Exchange may be taken as about 4,000 men—rather less than two-thirds, that is, of the 6,200 admitted number of members and House clerks. These days, it is probable that at 4 o'clock in the afternoon, the most crowded part of a business day, the number of men in all markets might be put down at 3,500 or fewer. As for the clients who are out of town, any broker would say that their name is legion. In these circumstances a brief review of what has taken place since the beginning of the year would seem to be appropriate and, it may be hoped, of interest.

Electricity Supply

Not many sections of the Stock Exchange share the home electricity supply market's distinction of having more than held its ground over the past seven months. Uncertainty as to the nature and timing of the legislation in store for the industry has done little to shake the high investment status of the leading shares. In consequence, this market has felt, in the same way as the gilt-edged market, the predilection of investment for stocks that afford safety and security. Prices faltered to some extent during the worst of the alarums in Europe, but have in the majority of cases recovered the setback, and with something to spare, as the table shows:—

Ordinary Share.	End 1937.	Lowest 1938.	Now.	Change on Year.
Bournemouth and Poole	67/6	62/6	66/3	— 1/3
Clyde Valley	40/–	33/6	37/6	— 2/6
County of London	49/–	45/3	49/6	+ 6d.
Lancashire Electric	33/–	31/3	32/–	— 1/–
Metropolitan	45/–	43/6	50/–	+ 5/–
Midland Counties	37'6	33/3	38/–	+ 6d.
North Eastern	32/–	26/6	33/–	+ 1/–
Scottish Power	37/–	34/–	38/–	+ 1/–
Yorkshire	39/6	37/6	41/–	+ 1/6

Dividends declared for 1937 held few surprises, except that of the Metropolitan Electric. This company's increase of 2 per cent., to 12 per cent., in the distribution accounts for the relatively big rise in the price of the shares. Edmundson's

shares have claimed a good deal of interest by reason of the group's activities and of the bonus issue.

Equipment and Manufacturing

Industrial markets have undergone various ups and downs this year, price movements corresponding with the course of events in Europe and elsewhere. As is evidenced in the following table of electrical equipment shares, prices suffered at one time a severe battering, from which they have made noteworthy recovery :—

Ordinary Shares.	End 1937.	Lowest 1938.	Now.	Change on Year.
British Insulated	4⅝	3⅞	4⅝	—
Callenders	4 7/16	3⅛	5 7/16	+12/6
English Electric	30/–	24/3	31/6	+ 1/6
General Electric	77/–	67/–	77/6	+ 6d.
Johnson & Phillips	41/3	34/–	38/9	– 2/6
Siemens	28/9	22/9	25/–	– 3/9
Telegraph Construction	2 7/16	36/–	2 7/16	– ¼

Higher dividends have been announced by, among others, General Electric, English Electric, Johnson & Phillips and Telegraph Construction. Satisfaction with these has been tempered by the signs that 1937 was evidently a peak year in trade for the time being. Most of the substantial rise in Callenders has taken place during the last few weeks, on account of the negotiations for a combination with Crompton Parkinson.

Telegraphs and Telephones

Developments have continued this year to crowd in thick and fast upon holders of Cable and Wireless issues. Following the declaration of the expected 4 per cent. on the written-down ordinary stock came news of the agreement with the Empire Governments, bringing with it the new flat rate, the fixing of a standard revenue, and other far-reaching decisions. Until June the monthly traffic indices were discouraging. The price of the ordinary stock stands well below the year's opening quotation, but it is also well above the worst, as is shown below :—

Share.	End 1937.	Lowest 1938.	Now.	Change on Year.
American Tel. & Tel.	146½	111	144½	– 2
Anglo-American Pref.	115½	105	110	– 5½
Cable and Wireless Ordinary ...	66½	43½	54	–12½
Cable & Wireless Pref.	102½	94	99	– 3½
Globe Ordinary	15¼	12⅜	32/- (Stock)	+ ⅛
Great Northern	40	34	38	– 2
International Tel. & Tel.	7½	5⅜	9⅜	+ 2½
Marconi Marine	28/9	22/6	27/6	– 1/16

Naturally the group has been sensitive to the international atmosphere and to the state of affairs in the United States. America's dramatic recovery of confidence since the middle of June has helped to strengthen the price list of communication stocks, particularly, of course, in the case of the United States concerns.

Traction and Transport

Apart from home railway issues, which suffered a severe relapse last month on news of the companies' half-yearly profits and dividends, home traction stocks have had, so far, a not unsatisfactory experience, of which the small change in the price of B.E.T. deferred, shown in the table below, is fairly typical. London Transport "C" stock, however, stands near the year's lowest point.

Share.	End 1937.	Lowest 1938.	Now.	Change on Year.
Anglo-Argentine Trams 1st Pref....	7/6	2/6	6/3	– 1/3
British Electric Traction Deferred	1,000	675	1,025	+ 25
Brazilian Traction	12⅜	7⅜	13⅛	+ ⅜
London Transport "C"	80	73½	74	– 6
West Riding	39/6	30/6	35/–	– 4/6

Brazilian Tractions were hit hard by the local political trend and by Wall Street's depression. The lifting of the latter is mainly responsible for the quotation's having made ground, on balance, since January. Argentine tramway stocks derived no advantage from the formation of the Buenos Aires transport consortium.

The Share-pushing Bill

What has come to be known as the Share-pushing Bill was introduced, as a formality, in the last days of the Parliament now adjourned until November 1st. The provisions of the Bill have been closely examined by the Press. They meet, on the whole, with approval, and are more comprehensive than had been expected. When debate opens, three months hence, alterations and modifications will be proposed. That is already certain. But it may be asserted that the Bill is a good one. It is likely to eradicate (now that the public have been swindled out of literally millions of pounds) methods by which the bucket shops and other thieves have preyed upon the credulity, ignorance and gullibility of the people. The Stock Exchange is profoundly concerned with the Bill, but members of the House happen to be temporarily intent upon certain domestic legislation proposed by their Committee. This detracts to some extent from the attention which the Bill would be otherwise receiving in the Stock Exchange.

Share List of Electrical Companies

	Dividend. Nom.	Previous.	Last.	Price Aug. 2.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	66/3	—	4 10 7
City of London	1	7½	7½	33/6	—	4 9 7
Clyde Valley	1	7	8	37/6	—	4 5 4
County of London	1	10½	10½	49/6	—	4 4 7
Edmundson's 7% Pref.	1	7	7	32/6	—	4 7 6
Do. Ord.	1	8	9	27/6	—	—
Elec. Dis. Yorkshire	1	9	9	42/6	—	4 4 9
Elec. Fin. and Securities	1	12½	12½	50/–	—	5 0 0
Elec. Supply Corporation ...	1	11	12	53/9	—	4 9 5
Lancs Light and Power	1	7½	7½	32/–	—	4 13 9
Lond. Assoc. Electric	1	—	7	30/–	—	4 13 4
London Electric	1	8	7	35/6	—	3 19 9
London Power Deb. Red. ...	Stock	5	5	106½	—	4 14 9
Metropolitan	1	10	12	50/–	—	4 16 0
Midland Counties	1	7½	8	38/–	—	4 4 3
Mid. Elec. Power	1	8	9	40/9	—	4 8 3
North Eastern Electric Ordinary	1	7	7	33/–	—	4 4 10
Do. 7% Pref.	1	7	7	33/–	—	4 4 10
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary ...	1	10	10	48/9	—	4 2 6
Do. do. 6% Pref.	1	6	6	29/6	—	4 1 4
Scottish Power	1	8	8	38/–	—	4 4 3
South London	1	7	7	32/–	—	4 7 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 0 9
Yorkshire Elec.*	1	8	8	41/–	—	3 18 1
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	113xd.	—	4 8 8
Do. 1955–75 ...	,,	5	5	116½	—	4 5 10
Do. 1951–73 ...	,,	4½	4½	109	—	4 2 7
Do. 1963–93 ...	,,	—	3½	100½	—	3 9 6
London Elec. Trans. Gtd. ...	,,	—	2½	92	—	2 14 4
London & Home Counties, 1955–75	,,	4½	4½	112½	—	4 0 6
London Passenger Transport, A...	,,	—	4½	118½	—	3 16 9
Do. do. B...	,,	—	5	119½	—	4 3 8
Do. do. C...	,,	4	4½	74	—	5 14 10
West Midlands Joint Elec. 1948–68	,,	—	5	112	—	4 9 3
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	144½	+2	6 4 7
Anglo-Am. Tel. Pref.	Stock	6	6	110	—	5 9 1
Do. Def.	,,	1½	1½	26	—	5 15 5
Cable & Wireless 5½% Pref. ...	,,	4½	5½	99	—	5 11 1
Do. Ord.	,,	—	4	54	–1	7 8 2
Do. Income	,,	—	—	102	—	3 18 2
Globe Tel. & Tel. Ord.	11	5½*	7½*	32/–	+½	4 13 9
Do. do. Pref.	11	6	6	27/–	–1	4 9 0
Great Northern Tel.	10	20	20	38	—	5 5 3
Marconi-Marine	1	10	7½	27/6	—	5 9 1
Oriental Telephone Ord.	1	12*	12*	58/9	—	4 1 8
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	6/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	5/–	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	13	—	—
British Electric Traction Def. Ord.	,,	5	5	1025	—	—
Do. do. Pref. Ord.	,,	8	8	170	—	4 14 2
Brazil Traction	$100	70 cts.	$1	13⅛	–¼	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	100	—	5 0 0
Mexican Light Common	$100	Nil	Nil	1	—	—
Do. do. 1st Bonds	$500	5	5	26¾xd.	—	—
Victoria Falls Ord.	1	12	13⅛	73/9	—	3 13 2
West Riding	1	6½	10	35/–	—	—
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	1⅛	—	9 4 8
Assoc. Elec. Ord.	1	10	10	39/–	—	5 2 7
Do. Pref.	1	8	8	36/6	—	4 7 6
Babcock & Wilcox	1	10	10	38/9	– 1/16	5 3 0
British Aluminium Ord.	1	10	12½	49/6	—	5 1 0
British Insulated Ord.	Stock	20	20	4⅝	—	4 6 6
Brush Ord.	,,	Nil	Nil	26½	—	—
Callenders'	1	20	20	5 7/16	+⅛	3 19 0
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord. ...	5/–	12½	12½	30/–	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	10	12½	32/6	—	7 13 10
Enfield Cable Ord.	1	25	25	2½	—	—
English Electric	1	Nil	10	31/6	—	6 7 0
Do. do. Pref.	1	6½	6½	26/–	—	5 0 0
Ericsson Tel.	5/–	25	25	38/9	—	3 4 5
Ever Ready	5/–	45	35	20/–	– 6d.	8 15 0
Ferranti Pref.	1	7	7	27/6	—	5 2 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	17½	20	77/6	—	5 3 0
Henley's	5/–	15	20	21/3	—	4 14 1
Do. 4½% Pref.	1	4½	4½	21/3	—	4 4 8
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	10	12½	38/9	+6d.	6 8 10
Lancashire Dynamo	1	20	25	3	—	8 6 8
Siemens Ord.	1	7½	7½	25/–	—	6 0 0
Telegraph Construction	£1	7½	10	2 7/16	+ 1/16	4 17 0

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1936

26957. "Television scanning means." Radioakt. Ges. D. S. Loewe. October 4th, 1935. (488419.)
29702. "Magnetic separators." H. H. Thompson, A. E. Davies and M. D. Thompson. November 2nd, 1936. (Cognate application 3402/37.) (488420.)
29783. "Telephones." A. De Benedetti. October 31st, 1935. (Cognate application 29784/36.) (488488.)
32944. "Means for blocking ionic valves by means of grids." Allmänna Svenska Elektriska Aktiebolaget. December 2nd, 1935. (488365.)
33381. "Electrical devices for checking the levels of substances in cartons, containers and the like." A. G. Rose and Rose Bros. (Gainsborough), Ltd. December 5th, 1936. (488366.)
33734. "Electrical appliances comprising a base member and a cap of insulating material clamped thereto by one or more bolts." P. Jordan. December 8th, 1936. (Convention date not granted.) (488554.)

1937

320. "Electric heating elements." British Thomson-Houston Co., Ltd., P. B. Brunt and C. E. Davis. January 5th, 1937. (488370.)
366/7. "Dynamo regulators." C.A.V.-Bosch and W. H. Glaser. January 6th, 1937. (Cognate application 9002/37.) (488424/5.)
407. "Electric-discharge vessel composed of metal." Radioakt. Ges. D. S. Loewe. January 9th, 1936. (488558.)
423. "Directional radio receiving systems." Marconi's Wireless Telegraph Co., Ltd. September 9th, 1936. (488611.)
434. "Scanning sound or combined sound and picture films." J. O. Van Leer. January 6th, 1936. (488559.)
435. "Telephone systems." Automatic Telephone & Electric Co., Ltd., J. W. McClew and A. H. Williams. January 6th, 1937. (488430.)
526. "Searchlights." S. E. Grubb and D. Wallis. January 7th, 1937. (488616.)
527. "Electric relay devices and the like." A. G. Kershaw and Westinghouse Brake & Signal Co., Ltd. January 7th, 1937. (488501.)
615. "Means for supporting mechanically vibrating elements such as piezo-electric crystals." Standard Telephones & Cables, Ltd. January 30th, 1936. (488564.)
617. "Electrical attenuating networks." Standard Telephones & Cables, Ltd., and R. M. Barnard. January 8th, 1937. (488565.)
625. "Superheterodyne receivers." Radioakt. Ges. D. S. Loewe. January 13th, 1936. (Addition to 458149.) (488566.)
655. "Electrically maintained vibrating bodies." A. E. Coyne. January 8th, 1937. (488502.)
675. Rotary distributors for use with ignition circuits of internal-combustion engines and for like purposes." A. H. Bailey. January 9th, 1937. (488570.)
721. "Electric resistances or condensers." Steatit-Magnesia Akt.-Ges. January 9th, 1936. (488289.)
736. "Self-starting motors for electric clocks and the like, and process of making the same." R. H. Whitehead. January 9th, 1937. (488575.)
853. "Automatic switches for use in telephone or like systems." Automatic Telephone & Electric Co., Ltd., C. E. Beale and I. T. Richards. January 11th, 1937. (488583.)
864. "Electric cables." Okonite Co. January 10th, 1936. (488432.)
1805. "Electrically heated liquid boilers and steam-raisers." General Electric Co., Ltd., and W. R. Cox. January 21st, 1937. (488292.)
2320. "Traffic-actuated apparatus." Siemens & General Electric Railway Signal Co., Ltd., J. P. Green and H. J. N. Riddle. January 26th, 1937. (488437.)
2718. "Electric resistances." S.E.C.I. Soc Elettrotecnica Chimica Italiana. February 13th, 1936. (488293.)
3206. "Gramophone pick-ups." British Thomson-Houston Co., Ltd., W. A. Bocock and H. Simpson. February 3rd, 1937. (488294.)
4693. "Electric heating-elements or hot-plates of or for electric cooking stoves and the like." R. J. Neil. February 17th, 1937. (488299.)
5831. "Electrical operation of flyer frames." E. Kato. June 20th, 1936. (488304.)
5888. "Electrical measuring instruments." G. L. Woolnough and Metropolitan-Vickers Electrical Co., Ltd. February 26th, 1937. (488507.)
6008. "Electric immersions heaters." Bulpitt & Sons, Ltd., and W. H. Bulpitt. March 1st, 1937. (488305.)
6439. "Thermionic oscillation generators." Telephone Manufacturing Co., Ltd., and L. H. Paddle. March 4th, 1937. (488508.)
6883. "Electric heating devices for waving or curling the hair." M. Coda. March 9th, 1937. (488309.)
7986. "Combined electric switch and socket units." General Electric Co., Ltd., and J. Langham. March 18th, 1937. (488312.)
9416. "Fuse elements for electric fuses." W. T. Henley's Telegraph Works Co., Ltd., and H. C. Hoban. April 2nd, 1937. (488446.)
10600. "Combined electric switches and coupling devices." G. F. P. E. Fourneaux. June 18th, 1936. (488447.)
10823. "Electric starting devices for internal-combustion engines." Sperry Gyroscope Co. Inc. April 15th. 1936. (488388.)
15342. "Electric welding machines." British Thomson-Houston Co., Ltd. June 4th, 1936. (488324.)
16268. "Carrier-wave modulating systems." C. Lorenz Akt.-Ges. June 13th, 1936. (488393.)
20797. "High-tension cartridge and like fuses." Electric Transmission, Ltd., and K. Dannenberg. May 4th, 1937. (Divided out of 12770/37.) (488331.)
21362. "Sound head for talking-film reproducing apparatus." B. Chatterjee. August 3rd, 1937. (488456.)
21424. "Electric-discharge tubes." Quarzlampen Ges. August 3rd. 1936. (488516.)
24036. "Electrically heated hot-water heating installations." Siemens-Schuckertwerke Akt.-Ges. September 2nd, 1936. (Cognate application 24037/37.) (488333.)
24136. "Devices for the audible detection of high-frequency currents." Siemens & Halske Akt.-Ges. November 23rd, 1936. (488517.)
28797. "Electric circuit-breakers having isolating arrangements." H. A. H. Nijland. November 17th, 1936. (488342.)
29256. "Electro-cardiographs and the production of electrocardiograms." Siemens & Halske Akt.-Ges. October 26th, 1936. (488465.)
30895. "Means for attaching parts, particularly circuit elements, to plates." Steatit-Magnesia Akt.-Ges. November 11th, 1936. (488346.)
31400. "Feeding of electric current and the transmission of the advancing movement to covered electrodes used in automatic welding." Elin Akt.-Ges für Elektrische Industrie. November 14th, 1936. (488524.)
31905. "Annular electric windings." British Thomson-Houston Co., Ltd. November 21st, 1936. (Cognate application 31906/37.) (488349.)
32405. "Electrically heated soldering irons." S. Sachs. November 24th, 1937. (488351.)
32408. "Devices comprising at least one super-pressure mercury-vapour discharge tube." Naamlooze Vennootschap Philips' Gloielampenfabrieken. November 27th, 1936. (488352.)
33334. "High-pressure positive column electric-arc lamp." Vereinigte Glühlampen und Elektrizitäts Akt.-Ges. December 2nd, 1936. (488471.)

1938

204. "Toy electric railway vehicles." Vereinigte Spielwarenfabrieken A. Fortner and J. Haffner's Nachfolger Ges. February 27th, 1937. (488357.)
1349. "Electric current control-panels." G. B. Seawright. January 14th, 1938. (488478.)
1399. "Ships' and like telegraph apparatus." Chadburn's Ship Telegraph Co., Ltd., and A. C. Bamford. January 15th, 1938. (488604.)
1951. "Electric transformer regulating systems." British-Thomson-Houston Co., Ltd. March 20th, 1936. (Divided out of 487354.) (488360.)
2664. "Methods and devices for the expansion or contraction in duration of electric signals." F. C. P. Henroteau. January 27th, 1938. (488605.)
7496. "Resistance-capacity coupling-circuits for electric amplifiers." R. Elmqvist. (March 10th, 1937.) (488413.)
8055. "Hand appliances for electrical spot-welding." Daimler-Benz Akt.-Ges. March 15th, 1937. (488414.)
9068. "Television scanning means." Radioakt. Ges. D. S. Loewe. October 4th, 1935. (Divided out of 488419.) (488486.)
11089. "Electron-optical lens systems for electron discharge tubes." V. Zeitline, A. Zeitline and V. Kliatchko. May 5th, 1936. (Divided out of 486204.) (488416.)
15702. "Electrical apparatus for indicating the presence of certain frequencies in a complex sound." A. E. Coyne. January 8th, 1937. (Divided out of 488502.) (488629.)
16803. "Tubes for concealing the flex of electric light pendants." H. R. Pricket. January 1st, 1937. (Divided out of 488204.) (488547.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month of July 27th :—

Draloperm. No. 579501. Class 5. Metallic cores for inductance coils.—Steatit-Magnesia Gesellschaft, Pankow, Berlin. (British representatives : Gill-Jennings and Every-Clayton, 51-52, Chancery Lane, W.C.2.)

Head and Eye (design only). No. 585836. Class 8. Philosophical and scientific instruments and apparatus.—Fernsch Gesellschaft, Zehlendorf, Berlin. (British representatives : Boult, Wade & Tennant, 111-112, Hatton Garden, E.C.1.)

Neco. No. 583850. Class 8. Electric cables, dry cells, inductance coils and accumulators, all for use with motor-cars.—Nera Electrical Co., 327-329, Kennington Road, S.E.11.

Atmostherm. No. 586214. Class 18. Engineering, architectural and building contrivances.—Carrier Engineering Co., Ltd., 24, Buckingham Gate, S.W.1.

Tynolex. No. 585890. Class 50. Compositions made of paper impregnated with artificial resins and sold in sheets, rods or tubes for electrical insulating purposes.—Bushing Co., Ltd., South Drive, Hebburn-on-Tyne, Durham.

Aluminium from Power Station Waste

ACCORDING to the laboratories of the Dzerjinsky Technical Heat Institute, the average content of aluminium oxide in the brown coal which is used in some of the large Soviet power stations varies between 23 and 40 per cent. The ash from this coal can, it is claimed, provide an important source for obtaining aluminium oxide, from which the metal can be extracted by electrolysis. The Stalin power station at Stalinogorsk is cited as an example. If the capacity of this station were raised to 500,000 kW, some 60,000 metric tons of aluminium oxide could yearly be obtained from the ash (which would mean 30,000 tons of aluminium), as well as 316,000 tons of ammonium sulphate, 660,000 tons of portland cement, and 10,400 tons of copperas. These calculations are based on the utilisation of only 45 per cent. of the ash, for use with which sufficient sulphuric acid could be obtained from the power station waste fumes. The remaining 55 per cent. could be used for making firebricks and building materials. The costs of production at the existing aluminium works in the Urals and the aluminium oxide works at Stalinogorsk are 1,070 and 1,250 roubles per ton. The All-Union Aluminium-Magnesium Institute calculates that the new method should cost from 193 to 229 roubles a ton, according to the *Bulletin* of the Russo-British Chamber of Commerce.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Extensions to factory, for G. Beaton & Sons, Ltd., Victoria Road. Extensions to technical college (£13,348); T. Lowe & Sons, Ltd.

Barking.—Houses and flats, Scrattons Farm estate; Unit Construction Co., Ltd. Factory, River Road; Thomas Bates & Son, Ltd. Shops and flats, London Road; Cricklewood Property & Investment Trust. School, Porters Avenue; R.C. trustees. Extensions to factory, London Road; Kitsons Insulations, Ltd.

Bedworth.—Houses (42), Blackhorse estate; U.D.C. surveyor.

Berkshire.—School, Sunninghill, Ascot (£22,530), for the County E.C.

Berwick-on-Tweed.—School; J. H. Pearce, contractor, Dumbarton.

Birkenhead.—Tenements and shops, Dock Cottage area; Lloyd & Cross, Ltd.

Brackley.—Houses (110); R.D.C. surveyor.

Bromsgrove.—Additions to Council House (£15,000), for U.D.C.; Batemans, architects, 19, Bennett's Hill, Birmingham.

Croydon.—Extensions to factory for W. Howard Price, Ltd., Lower Coombe Street.

Dalkeith.—Cinema, Buccleuch Street (£15,000); secretary, Caledonian Associated Cinema, Ltd., Inverness.

Darlington.—Houses (100), Longfield Road, for employés of Darlington Rolling Mills Co., Ltd., Rise Carr Mills.

Darton.—Extensions to Redbrook mill, for Richardson, Tee, Ryecroft & Co., Ltd.

Denham.—Converting mansion as school (£7,140); W. S. Try, Ltd.

Dumfries.—Police buildings for County and Burgh (£27,000); burgh surveyor.

Durham.—Hospital (£100,000); County Orthopædic Association.

Ealing.—Refuse works, Greenford (£68,500); borough engineer.

Easthampstead.—Extensions to Institution (£7,726); H. Hoskins.

East Retford.—Extensions to Milner school, for the E.C.

Eastwood (RENFREWSHIRE).—Houses (112); Mactaggert and Mickel, Ltd., builders, 65, Bath Street, Glasgow.

Eccles.—Senior school (£23,300); Godfrey Ermen Memorial Schools Trustees.

Edinburgh.—Motor coach building premises and showroom, Dundee Street, for Commercial Coachcraft Co.; the manager.

Edgware (MIDDLESEX).—Enlargement of Redhill hospital (£52,000); county architect.

Farington.—Extensions to County girls' school (£7,916); Building & Public Works Construction Co., Ltd.

Gainsborough.—Buildings for the Grammar school, Girls' High school and technical college (£84,000); education architect.

Gateshead.—Swimming baths for the T.C.; A. Pringle, Ltd., builders, Cramer Dykes.

Glasgow.—Garage, Knightswood, for the Corporation Transport department; city architect.

Greenhithe.—Factory, Taunton Road, Swanscombe, for Kent Paper Sacks, Ltd.

Greenock.—Dairy premises (machinery and apparatus for treatment of milk, illuminated signs for night lighting, &c.), for Greenock Central Co-operative Society; M. S. Swan, managing secretary.

Guildford.—Houses (17), Rydes Hill estate; Mount Ryde Development Co. Bank, High Street; Martin's Bank, Ltd.

Haydock.—Houses (124), Church estate; U.D.C. surveyor.

Haydon Bridge (NORTHUMBERLAND).—Practical room, Shaftoe Trust school, for the C.C.; Middlemiss Bros., builders, Stepney Bank, Newcastle-on-Tyne.

Hetton-le-Hole (Co. DURHAM).—Swimming baths for the U.D.C. (£32,000); A. H. Fennell, architect, Bridge End Chambers, Chester-le-Street.

Hornchurch.—Dance Hall, Byron Parade, Upminster, for Academy Electric Building Co.

Ilford.—School, Park Hill (£37,146); Taylor Woodrow Construction Co., Ltd.

Ipswich.—Additions to the Ipswich school for the Governors; Cautley & Barefoot, architects, The Thoro'fare.

Isle of Ely.—Children's homes, Downham Road, Ely; county architect.

Kimberley.—School, Newdicate Lane (£24,845); Harris Bros. (Marehay), Ltd.

Knaresborough (NEAR HARROGATE).—Cinema, near Market Place, for the Radion Cinema Construction Co., Ltd., Piccadilly House, Jermyn Street, London, S.W.1; J. King, architect, 16-17, Jermyn Street, London, S.W.1.

Leeds.—Houses (14), Cliff Road, Woodhouse; F. A. Winterburn. Central baths; J. A. McLay, consulting electric engineer, Stores, Gipton estate; Leeds Co-operative Society, Ltd. Children's hospital, Moortown estate; clearance schemes (£200,000), and enlargement of Coldcotes school, Gipton estate; city architect.

Leicester.—Houses (150), for the City Council.

Limehurst.—Houses (48); R.D.C. surveyor.

Liverpool.—Works, Speke Hall Road, for Clarke Bros. (Liverpool), Ltd., Park works, Gorse Bank Road, Wavertree; A. E. Shennan, architect, 17, North John Street, Liverpool.

London.—(FULHAM).—Dwellings, Fulham Road; borough engineer. (KENSINGTON).—Offices and library (£218,500), for B.C. (POPLAR).—Factory, Three Mill Lane; F. Bradford & Co., Ltd., Lessen estate, Angel Road, N.18. (ST. JOHN'S WOOD).—Houses (18), Hamilton Terrace; Binns & Scarlett, 19, Southampton Street, W.C.1. (ST. MARYLEBONE).—Offices and showrooms, Newman Street and Berners Street; Waite & Waite, 36, Cavendish Square, W.1. Offices, Paddington Street and Chiltern Street; J. Stanley Beard & Bennett, 101, Baker Street, W.1. Extensions to Broadcasting House, Portland Place; B.B.C.

Maldon.—Houses (58); R.D.C. surveyor.

Manchester.—Houses, Hillside Avenue, Blackley, for Lees estate (Manchester), Ltd.; S. Beck, architect, Reform Club Buildings, Farnworth. Rebuilding the Central Cinema, Clowes Street and Dorset Street, Gorton, for A. Lancashire; E. B. Jones and Rawlinson, Ltd., contractors, 6, Leaf Square, Pendleton, Salford, 6.

Mansfield.—Enlargement of Forest Hospital; borough engineer. Extensions to works, Union Street; Stokes Castings, Ltd.

Middlesbrough.—Houses, north end of town, for the Cleveland Trust, Ltd., Royal Exchange.

Middlesex.—Enlargement of North Middlesex Hospital (£1,219,000) and extensions to Shenley Mental colony; county architect.

Morecambe.—Houses (11), Hestham Grove; F. V. Hollinshead. Theatre, café and shops, Marine Road; Empire Theatre, Ltd.

Newbury.—Extensions to Grammar school; Governors.

Newcastle-on-Tyne.—Houses (16), Redcar Lane; Wilkinson Bros., builders, 205, High Street, Gateshead. Houses (41), Stocksfield Avenue, for Car and Kirk; F. M. Dryden, architect, Market Street. Cinema, Scotswood, for J. R. Scott; E. Thompson, contractor, 12, Grey Street. Rebuilding works, St. Andrews Street, for Harding and Son; Jackson and Son, builders, Corporation Street. Rehousing plan, for the City Council (£686,284) · city architect, 18, Cloth Market. Three shops and houses, West Road; E. Jeffcock, builder, Lemington.

Northampton.—Houses (29), near Welford Road; A. Glenn and Sons, Ltd., Chaucer Street.

Northamptonshire.—Wing, junior school, Rockingham Road, Corby (£5,500), for the County Council; A. Richmond and Sons, Retford.

North Shields.—Houses in flats, Balkwell estate; S. Pye, builder, Waterville Road.

Northumberland.—Cookery and domestic science college, for the C.C. (£70,000); county architect, County Hall, Newcastle-on-Tyne.

Penzance.—Additions to the Art school; borough surveyor.

Pinner.—School, Hatch End (£17,380); A. & B. Hanson, Ltd.

Pontypool.—Houses (24), Blaendare Road and Abersychan; A. Langley, architect, Midland Bank Chambers.

Rugby.—Premises, Wolvey,Burbage, for Co-operative Society, Ltd.

Ruislip.—School, Ruislip Gardens (£32,420); W. A. James & Sons.

Selston.—School (£34,436); Harris Bros. (Marehay), Ltd.

Silksworth.—Sportsdrome, for Young and Hedley; Marshall, Tweedy and Bourn, architects, Grainger House, Blackett Street, Newcastle-on-Tyne.

Smethwick.—Shops, Cape Hill; Montague Burton, Ltd.

South Shields.—School gymnasium (£13,400); H. Hill, architect. Alterations to Criterion Hotel, Ocean Road; E. M. Lawson.

Spennymoor.—People's theatre, for the Spennymoor Settlement; C. Elgey, architect, Durham.

Staines.—School, Kingston Road (£61,925); J. Carmichael (Contractors), Ltd.

Sudbury.—School, Perrin Road (£38,918); F. Troy & Co., Ltd.

Sutton Coldfield.—Houses (15), Donegal Road; S. Thornwork. Houses (16), Worcester Lane; Newbury & Son.

Taunton. —Houses, Halcon estate and Lyngford estate; borough engineer.

Thornley.—Cinema, Dyke Street; W. L. Grant, builder, 8, Loaning Burn, Easington.

Tottenham.—Factory, South Grove; E. Brown & Co. Office and works, Willoughly Lane; W. Press & Son. Extensions to isolation hospital (£155,685); Southgate and Tottenham Corporations. Reconstruction of St. Ann's library (£11,000); borough engineer.

Twickenham.—Shops and flats, St. Margarets Road and The Avenue; Howard Leicester & Partners.

Tynemouth.—Development of Preston Colliery estate; Ritson & Sons. Flats (20), Balkwell estate; T. Swan, builder, North Shields.

West Bridgford.—Police station (£4,645); G. T. Lovett & Sons.

West Bromwich.—Shops and houses, Hill Top, for Harford, Kingham & Co., 339, High Street.

Whitley Bay.—Flats (20), Fairfield Drive; J. R. Sherwood, architect, 32, Clayton Street, Newcastle-on-Tyne.

Wigan.—Houses (172), Worsley Hall estate; borough engineer.

Wolverhampton.—Houses (72), Rake Gate estate; W. Winsper. Factory, Church Street; Windridge's Prams, Ltd. Eighteen shops and flats, Stafford Road, for E. A. Colman, Cecil Chambers, 39, Newhall Street, Birmingham, 3; Drayco Ltd., contractors, Lancing.

Yorkshire.—School, Eston, North Riding; county architect, County Hall, Northallerton.